RAILROAD GAZETTE

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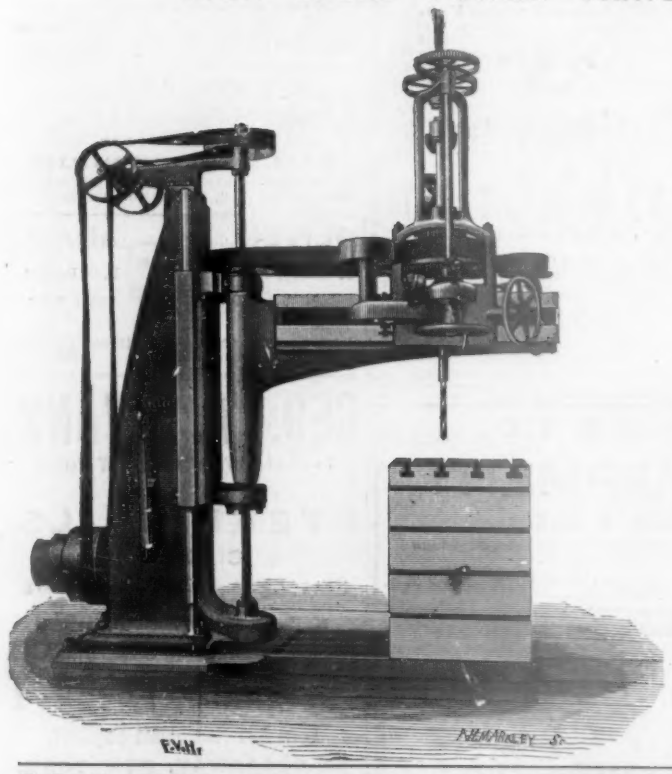

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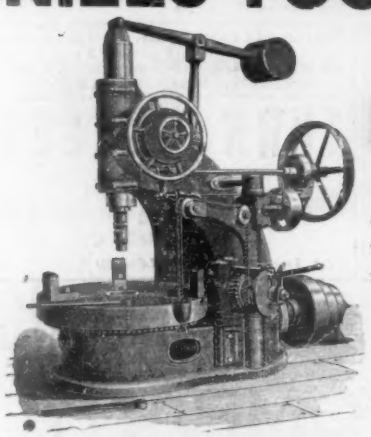

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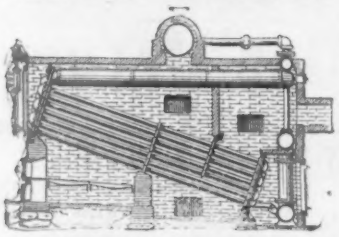

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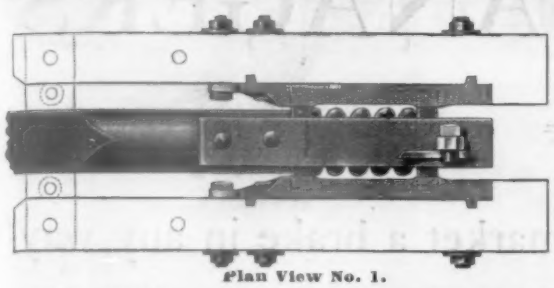
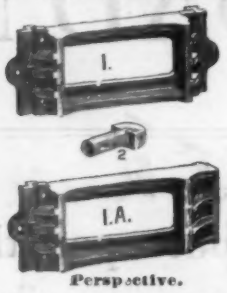
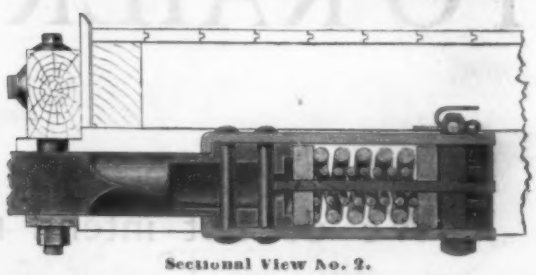


Plan View No. 1.



Perspective.



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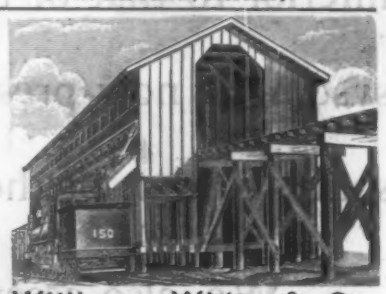

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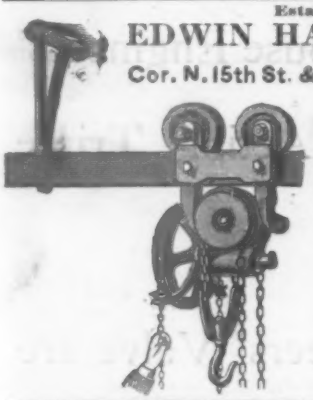

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[Classified Index on the next page.

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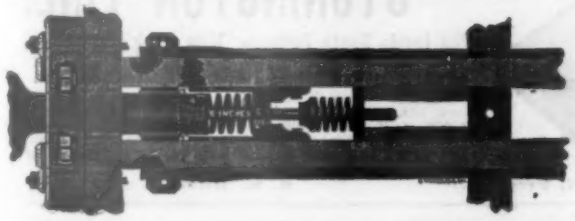

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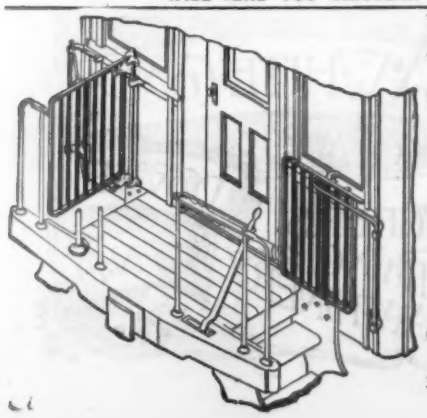

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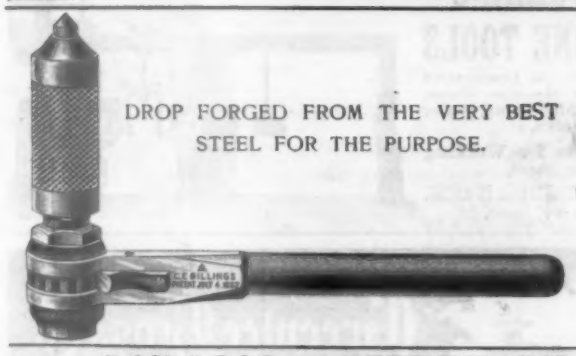

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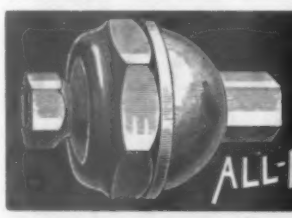

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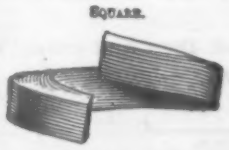

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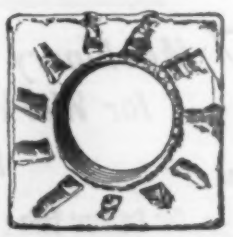

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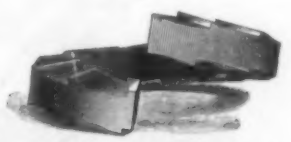

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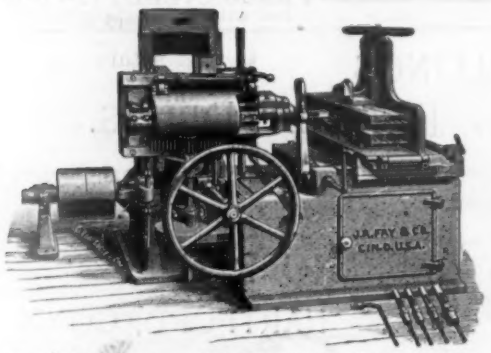

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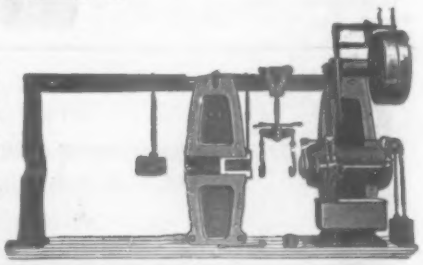

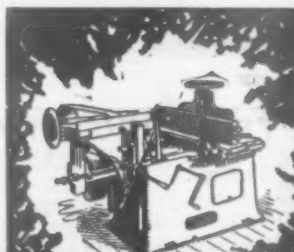

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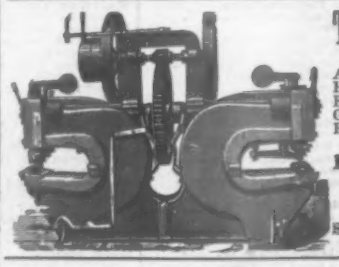

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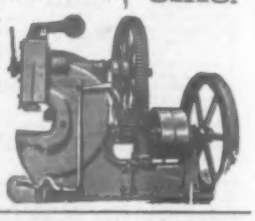

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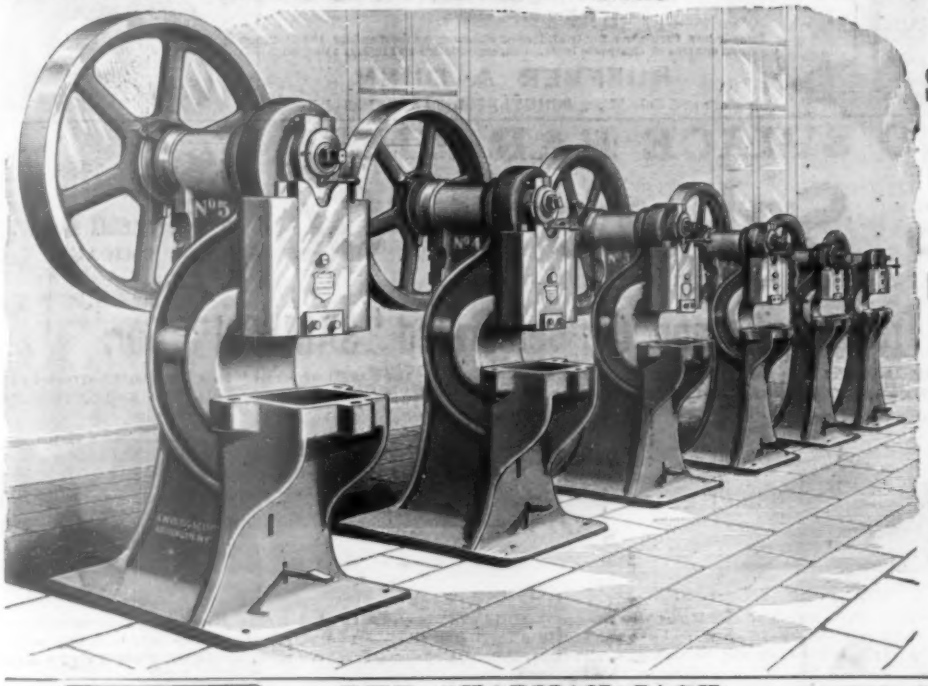

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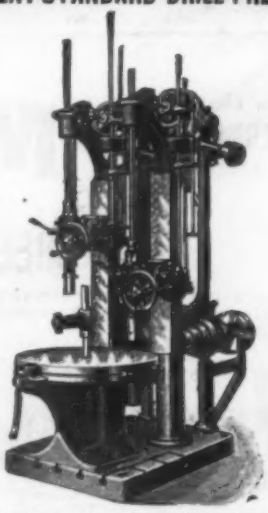

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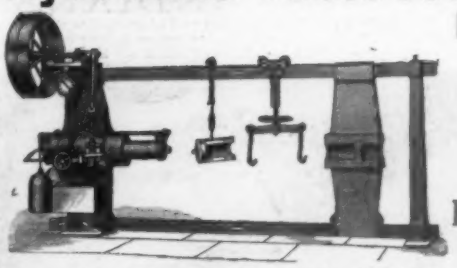

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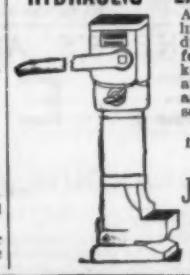

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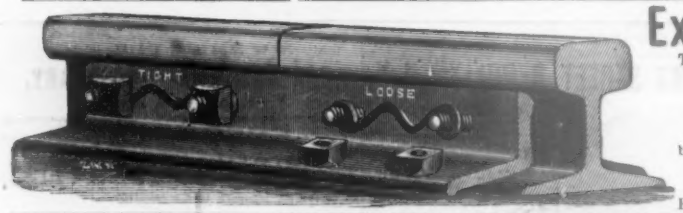

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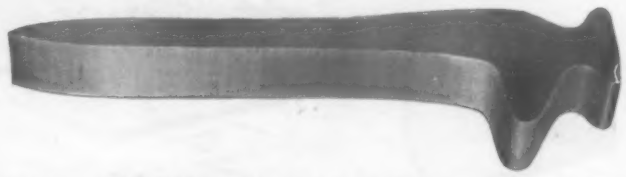

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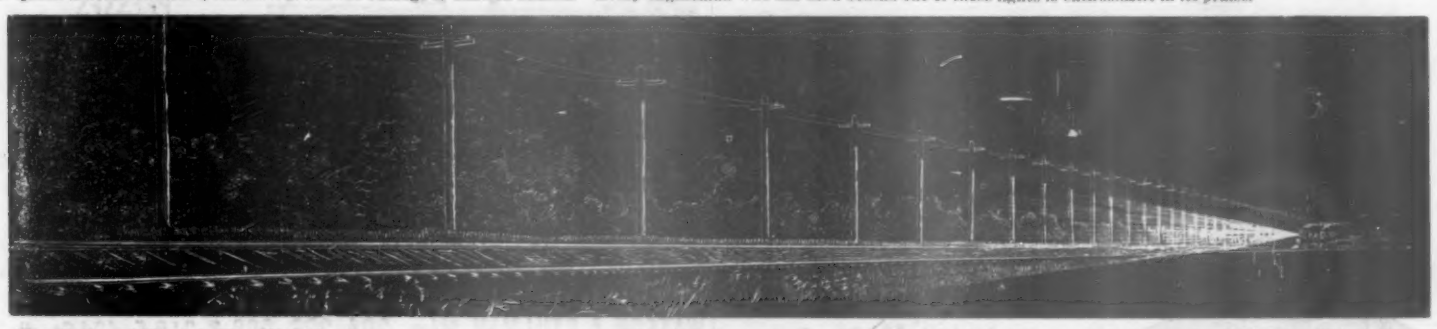

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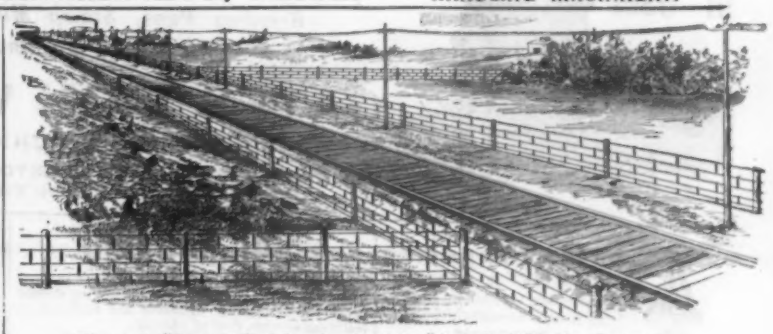

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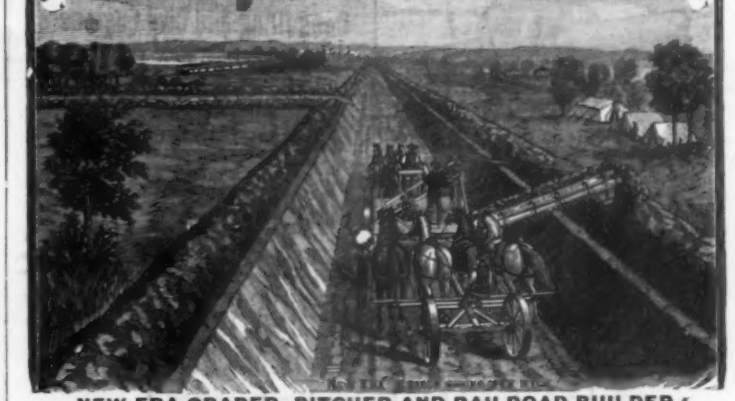

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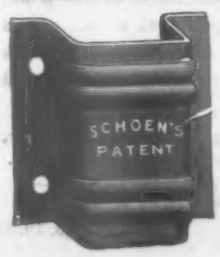

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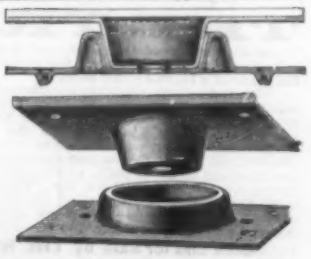

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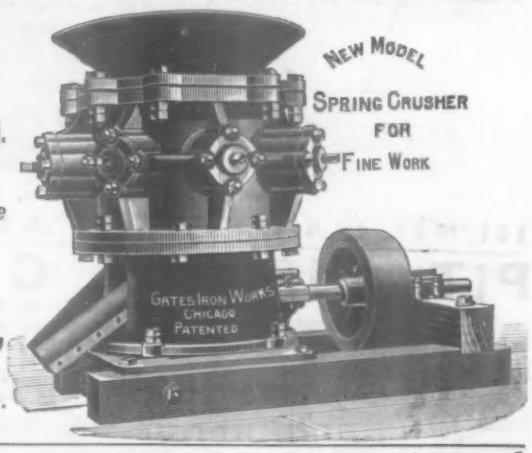

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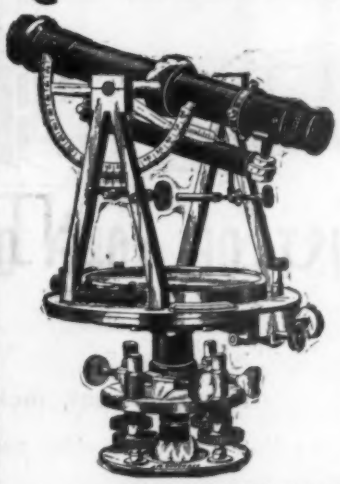

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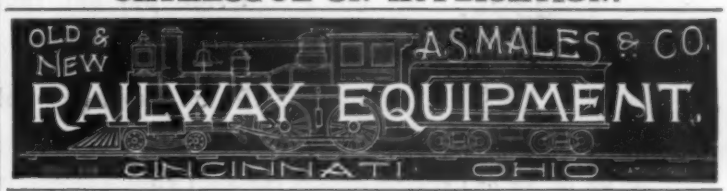

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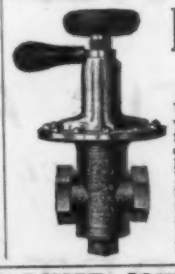

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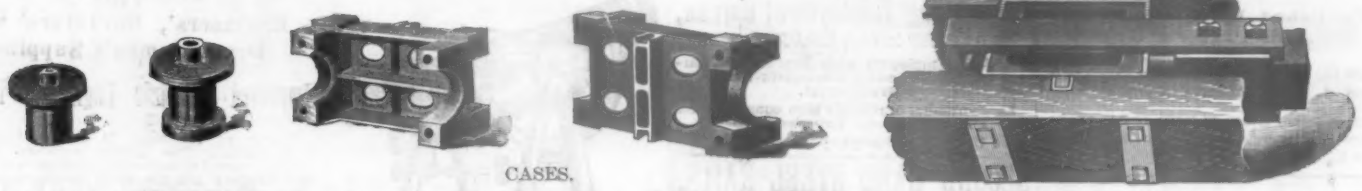

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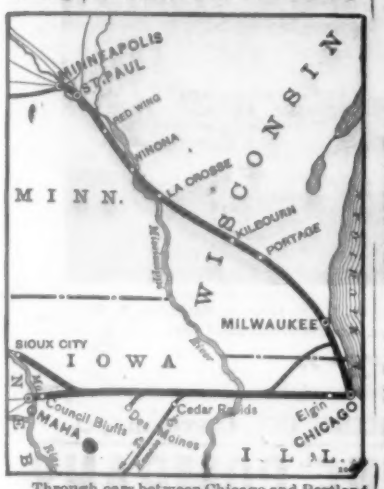

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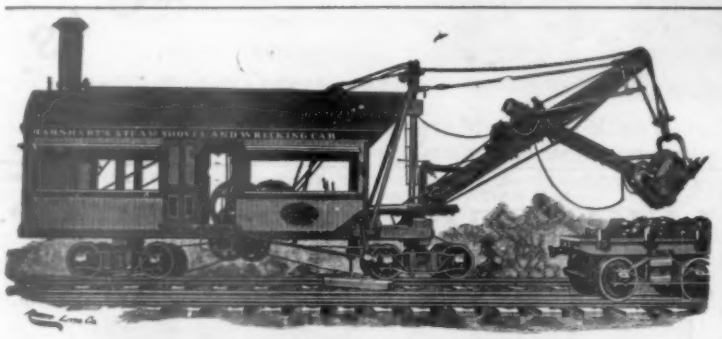

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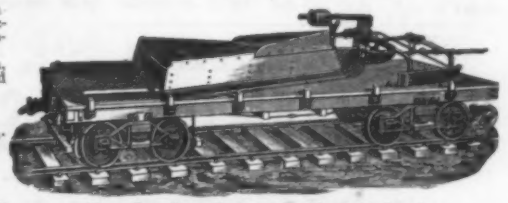

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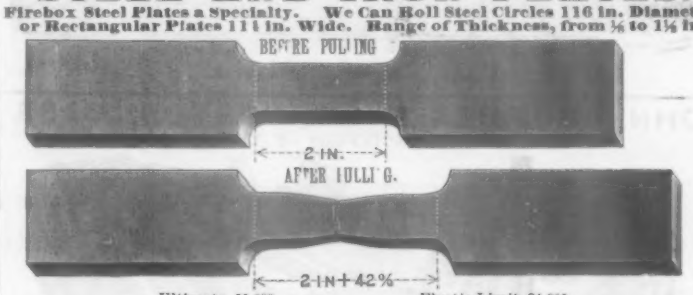

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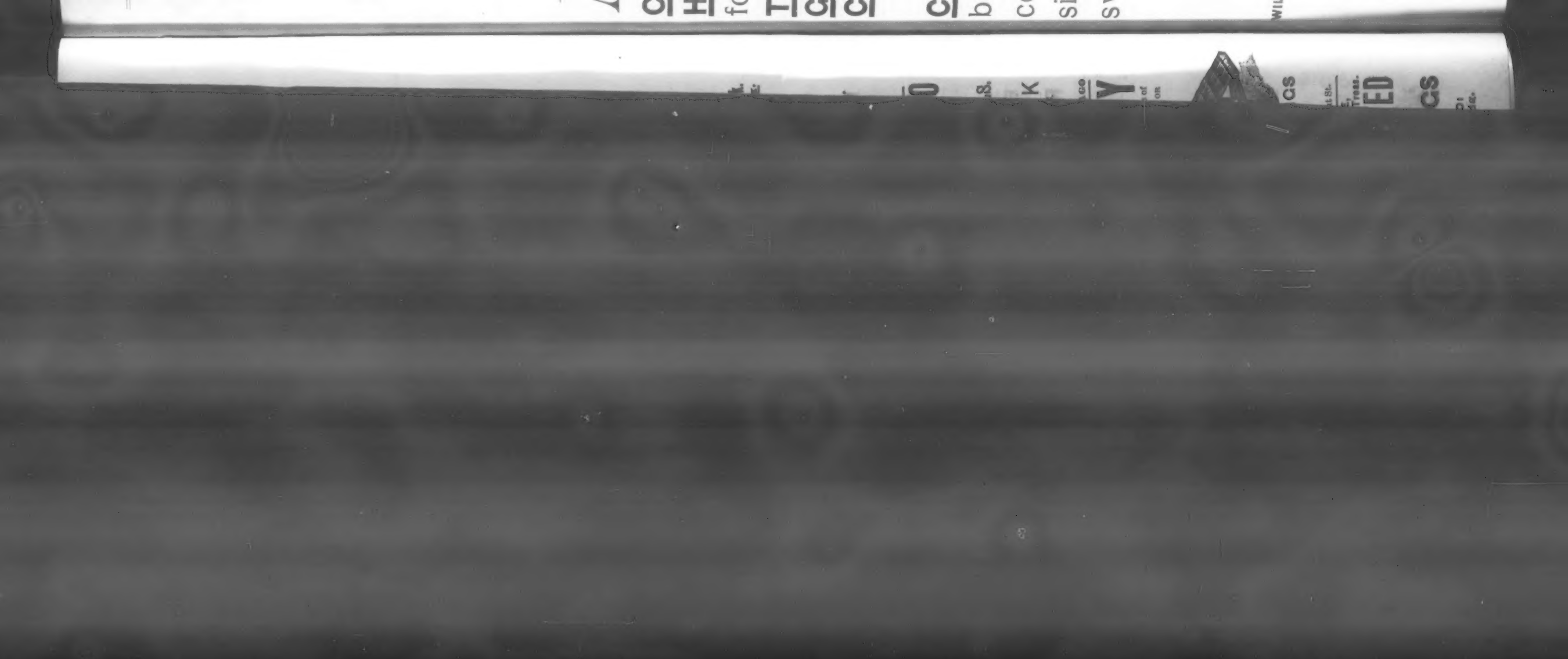

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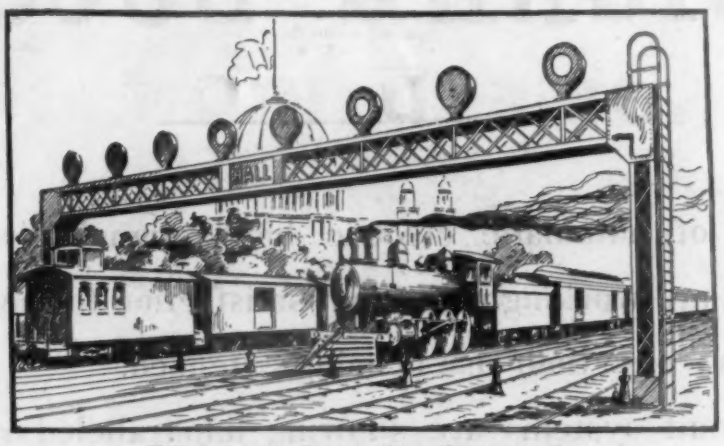

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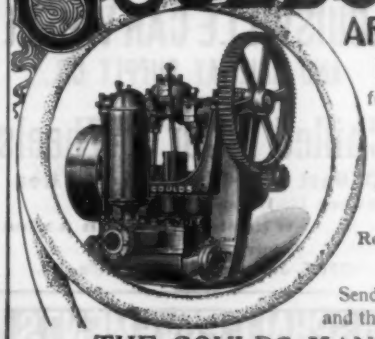

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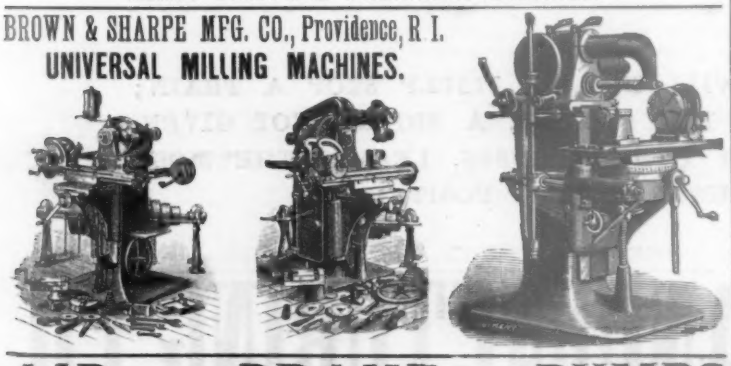

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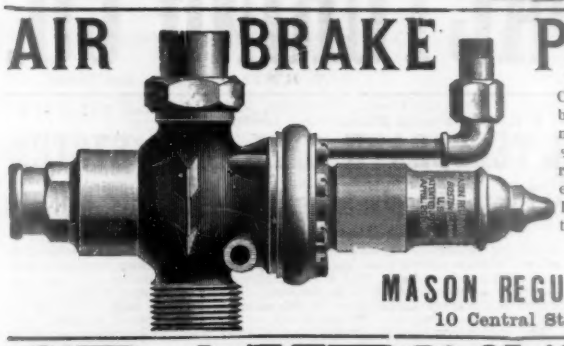

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RAILROAD GAZETTE

FRIDAY, JUNE 24.

CONTENTS.

Contributions.

Basic and Acid Steels.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I write to ask some of your readers, who have had experience with various firebox steels, for a clear distinction between what are known as the "acid" and "basic" processes of manufacture of steel for locomotive boilers, and to get some references, if possible, showing the comparative value of acid and basic steel for fireboxes. I write this not out of mere curiosity, but to obtain some definite information to enable me to decide which is the better of the two processes, and if there is a defect in either process that renders the steel produced unreliable for firebox purposes. At the present time there is a strong competition among manufacturers of steel, and it is difficult to decide from the many representations which is the best. No one who is careful will use anything but the very best firebox material that can be purchased, regardless of price, as the cost of a firebox sheet is but a small fraction of the cost of renewing it if it fails. I know of fireboxes that have been in use 14 years and are still in good condition, and others that are badly cracked which have been in use only two years. If there is anything in the acid or the basic process that would tend to produce an inferior steel for firebox purposes, I think you will confer a favor on others as well as myself by giving the facts.

FIREBOX.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Answering the letter of "Firebox," I venture to make the following suggestions as to the distinction between what is known as the acid and basic processes.

The acid open hearth steel is melted on a silica or "acid" bottom, the slags are therefore necessarily acid and will not combine with the phosphorus as it is oxidized in the steel, and the latter element is immediately recombined with the metal.

Basic open hearth steel, as its name indicates, is melted on a basic bottom, which may be formed of lime or magnesia. In either case additions of lime are made to the bath to insure a highly basic slag which will be sure to hold all of the phosphorus as fast as it is oxidized from the metal.

The acid is principally a melting process and none of the impurities in the metal used can be removed, except carbon and silicon. The consequence is that the quality of the steel made is dependent upon the quality of the metal used and it cannot be made better, but may be worse, that is, containing more impurities in the shape of phosphorous and sulphur than were found in the original stock. On the contrary, in the basic process, no matter how good or bad the materials used, a large proportion of the phosphorus (in the hands of a skillful workman as high as 90 per cent. of it and some of the sulphur) can be removed. This makes it possible by the use of this process to take even a low phosphorous iron ordinarily used in the acid open hearth and make it even better by removing a large proportion of the small quantity of phosphorus which it contains.

There is no reason why the basic process should not make as good steel as acid, but there is every reason why it should make better, and if chemical or physical tests show anything, it is better in every respect. The developments of the basic process abroad and the results attained, both as to the quality of steel and economical production, are such, that after careful study no one can fail to come to the conclusion that the basic open hearth process is sure to supersede the present acid processes.

I intended to draw your attention to the numerous articles and papers on basic open hearth steel written by acknowledged authorities abroad. But, just as I was about to write you, I received by mail the Spring proceedings of the British Iron & Steel Institute, and, as these proceedings will be published by many technical papers, thus giving all an opportunity to read them, I shall not enumerate the numerous articles written in foreign journals, as the latter are not available to many.

The facts concerning basic steel mentioned at the meeting and the discussions brought such information as to satisfy any fair mind. Mr. Carnegie stated at the meeting that he had fourteen open hearth furnaces running constantly on basic steel and an exhaustive series of tests which had just been undertaken by the Pennsylvania Railroad, conducted by his own people; had not only placed basic steel along side of acid steel for boilers and fireboxes, but he was informed that the question was being seriously entertained whether it would not be generally specified that nothing but basic steel should be used for those purposes.

A careful investigation of the present American open hearth practice will show very clearly that the opposition to basic steel, coming from certain quarters, is solely due to commercial considerations, and not to any metallurgical ones.

The firms producing low, phosphorous acid open hearth steel are obliged to use expensive raw materials, such as low phosphorus pig iron, generally made out of Spanish ores, and they also use so-called washed metal, made by treating American Bessemer pig iron by the Krupp-Bell process. The scrap and other material used in admixture are principally plate scrap and basic crop ends. Blooms, either puddled or those made from ore, are used by but two firms in Pittsburgh. The basic crop ends have been used largely for several years by the principal acid plate producers. The resulting acid steel is nevertheless higher in phosphorus than the basic steel.

The Illinois Steel Co., after careful consideration of the merits of both kinds of steel for plates, have also decided to erect four large basic furnaces with room for many more.

It is poor policy for the acid plate producers to oppose the introduction and progress of basic steel, for basic steel makers could make specifications, both chemical and mechanical, which the acid steel makers cannot fulfill, and it is to the latter's interest to consider the remarks (applicable in the United States) of Sir Alfred Hickman at the Spring meeting of the British Iron & Steel Institute to the effect that the process was now well established, and whether they adopted it or not their competitors abroad had done so, and if it were not adopted in England they would certainly be left behind.

GEORGE W. GOETZ.

Electric Motors as Substitutes for Steam Locomotives.

BY ARTHUR T. WOODS.

Judging from the editorial notes which appear frequently in certain "electrical" journals, the reader might naturally infer that "steam engineers" are a class of thick headed obstructionists who can see nothing good in electricity in any shape, while on the other hand certain "mechanical" journals would apparently have their readers believe that electrical engineers are ready to back any scheme, no matter how visionary, provided it involves the electrical distribution of power. Here is a recent sample from a prominent electrical journal which has until recently occupied a very conservative position in regard to electricity as applied to steam roads:

"Prompted probably by the near approach of a formidable rival in the form of electric locomotives, the builders of steam locomotives are continuing to make a little progress. Although the improvements are doubtless looked upon as important ones in the minds of steam engineers, nevertheless the actual increase of speed gained thereby, though not small, is by no means a great step in the solution of the problem of interurban rapid transit. Like the efficiency of the steam engine, the speed of a modern locomotive is already very near to a limit which it cannot exceed from the very nature of its construction. Just as the speed of a revolving wheel, and therefore that of an electric motor, is limited quite definitely by the bursting of the parts, so the speed of the present locomotive is limited by the hammer blow of the reciprocating parts. Besides this the danger of breakage increases very rapidly for higher speeds of steam locomotives. An increase of their size also requires heavier rails and stronger bridges."

Statements such as the above do not help the cause of electric traction, rather the contrary. Why not meet the question fairly and say that when it can be clearly demonstrated that it will pay to change the form of motive power on railroads it will be done and not before?

The possible advantages of electricity as a motive power over steam locomotives are greater cleanliness, higher speed and reduced cost of operation, including interest charges, depreciation and repairs in the latter. The greater cleanliness is evident and in some locations will doubtless prove to be a strong argument. Possible higher speed, as far as the structure of the locomotive is concerned, and as compared with the present types of steam locomotives may be also admitted to some extent, but the limiting speed for such locomotives has not yet been reached. The writer has carefully investigated the effects of the reciprocating parts of locomotives at high speed and is confident that there is no reason why steam locomotives cannot be built to run at a speed of 100 miles an hour and possibly considerably higher. That locomotives which were not intended for exceptionally high speeds have made runs at over 90 miles an hour simply speaks well for their construction, it does not prove that the limit has been very nearly reached. The difficulty with such speeds is not a question of the locomotive, it is rather with signals, the distance necessary in which to stop, and the practical operation of a road for high and low speed trains at the same time. If the railroads throughout the country could be built with no grade crossings and for high speed service alone, the problem would be very different. Speeds could be attained with electric motors which are impracticable with the present forms of steam locomotives, and the problem would become simply one of there being enough high speed business to make the road a paying investment.

But the general railroad problem is not a question of great speed, but, rather, can existing railroads be operated electrically from power stations so as to show greater net earnings than they can by steam locomotives? If a perfectly general answer could be made to this question, it would have to be negative in the present state of the development of electrical machinery. There are, however, a few railroads for which the conditions are such that an opinion as to the commercial feasibility of employing electricity as the motive power can be properly given only after a careful estimate.

The general problem, as well as it can be generalized, has been carefully worked out by Messrs. Crosby and Bell in their recent treatise on the electric railway and their discussion is well worth careful reading by all who are interested in the subject.

The first question which arises is whether individual cars are to carry motors, as in street railroad service, or whether there are to be electric locomotives in place of the present steam locomotives. The motor-car method would involve an entire reorganization of the train system on most steam railroads, that is, frequent light trains instead of heavy trains at longer intervals. There would seem to be no great difficulty in this in some cases, as, for example, for suburban service, where the traffic is not heavy; but when such traffic is heavy, amounting as it does at times to trains of from 10 to 15 cars at five-minute intervals, and for freight service, electric locomotives at the head of the train seem to be the preferable, if not the only practical, solution. When, in addition to this, the many advantages of separate locomotives are considered, such as avoiding the multiplicity of trains, the taking on and setting off cars at stations, the fact that little or no change in the number and size of train crews would be necessary, and that for a given amount of power electric locomotives could be built cheaper and of higher efficiency than small motors, it is safe to say that if electricity is to be applied at all to existing roads, it must generally be by means of electric locomotives.

Assuming for the present that such locomotives could be as readily obtained in the market as steam locomotives of equal tractive power, the problem is reduced to the question of whether or not power can be generated in central stations, transmitted to electric locomotives and used to haul trains more cheaply, all considered, than the same work can be done by steam locomotives. In the power stations we would have the most economical type of steam engines for the particular locality and these stations could be located at the most advantageous points in the district to be covered. The indicated horse power thus economically generated suffers losses during transmission to trains in engine friction, in transmission to the electrical generators or dynamos, in the dynamos, in the line, in the electric locomotive, and in the air and track resistance of the locomotive. When finally delivered at the locomotive draw bar, the cost of this power, including interest and depreciation, must be enough less than the cost of the same power delivered at the same point by a steam locomotive to warrant the additional expenditure necessary for the electrical equipment. It is at once apparent that the problem is one requiring careful calculation at best, and when the uncertainty as to the probable losses in some of the links of the chain is considered, the difficulty of making an estimate which can successfully stand criticism will be appreciated.

At first glance, when it is stated that a horse-power can be developed in a triple-expansion condensing engine with about one-half the consumption of steam that is required in a good single-expansion locomotive, the proposition of making the substitution sounds not only feasible but attractive. But when it is learned, as stated by Messrs. Crosby and Bell, that a 40 per cent. loss "is about the best we do with our present systems of electric street car propulsion," and the difference has to cover the increased first cost, the evidence of increased net earnings is not so clear. And when we remember that this low water consumption of the triple-expansion engine is obtained only when working under the most favorable conditions, and when developing the power for which it is designed, and that when underloaded or overloaded its efficiency falls off rapidly, the electric side of the question does not look so financially attractive.

It is shown by a table which gives a summary of the

results of the estimates made by Messrs. Crosby and Bell that with 60 per cent. efficiency for the electric engine, electricity becomes more economical than steam only at about 140 miles per hour, and that for 80 per cent. efficiency the two are about equal at 60 miles per hour The 80 per cent. efficiency has not, I believe, yet been obtained in practice. At lower speeds, according to this table, steam locomotives are the more economical. Assuming these figures to be substantially correct, it follows that there is no immediate prospect of electricity becoming a competitor of steam for freight traffic. In this comparison a very economical type of stationary steam engine has been compared with a locomotive in which there is considerable room for improvement. It is therefore safe to say that until much more efficient means of generating and utilizing electric power are discovered, and as long as a steam engine in some form is the prime mover, no system of electric traction can compete commercially with compound steam locomotives for freight service. For passenger traffic it may be a competitor under certain conditions, as already stated, but there are several electrical problems yet to be solved before electricity will be commercially possible, except in rare instances. Judging from the high efficiency which has recently been developed in transmission of power by multiphase currents in Europe, the successful use of very high potentials, and the improvements which may reasonably be expected soon in alternating and multiphase current motors, it is not improbable that electricity may be applicable in localties where its use is now commercially impossible. The more uniform the volume of traffic, the higher the price of coal, and hence the greater the proportion which the cost of fuel bears to the total operating expenses, the higher the speed which is practicable and which will pay, and the greater the value of the absence of smoke and cinders, the greater are the probabilities of electricity being the best form in which to use power for railroads.

In the above it has been assumed that electric locomotives can be readily obtained. Until recently there was no evidence that builders of electrical machinery were prepared to undertake the construction of electric locomotives of sufficient capacity to replace steam locomotives of ordinary size, but it is now reported that three 80-ton electric locomotives have been ordered for use on the Baltimore Belt Railroad. This is the best to date, but as these locomotives are to work in tunnels, where freedom from smoke is an important factor, and as, according to the report, the locomotives are not to be delivered until "early next year," it is not very encouraging for the cause of electric traction.

Steam has been replaced by electricity upon at least one road, however, viz., the St. Louis & Suburban. It will be remembered that this road operated about three miles of cable road in the city, which connected with a narrow gauge steam division about sixteen miles long. During the past fall and winter the cable road has been converted into a trolley line, the gauge of the steam division has been widened, and the whole has been equipped electrically, with the power station located about seven miles from the city end of the line. For about eight miles from this end, the road is double track, and a street car service with from two to four minute intervals is maintained. The remaining 11 miles is single track, and cars are run at intervals of about 15 minutes to Ramona Park, which is about 12 miles from the city end of the line, while six trips per day are made over the remaining seven miles to Fiorissant. This is an exceptional case. The cable road was in bad shape, and if the form of power had not been changed, expensive repairs or reconstruction would have been necessary. As it is now, there is an electric street car line which gradually changes into a light traffic suburban line. The suburban part beyond the power station, which is conveniently located for coal supply, takes but a small part of the total power, and under these circumstances can probably be operated more cheaply than by steam locomotives. The average running time on this road is about 11.6 miles per hour, including stops, varying from about six miles per hour near the city end of the line to possibly 20 miles per hour for short distances in the suburbs.

The present status of the question of electric versus steam locomotives may be summarized as follows:

1. There is no prospect of electricity replacing steam for long distance freight traffic.

2. There is a possibility of electricity becoming an economical substitute for steam locomotives for high speed service wherever the traffic is sufficiently heavy and constant to warrant the construction of lines of track independent of those used for moderate speeds.

3. There are very few localities in the United States in which the conditions are such as to make such a substitution commercially possible, with the efficiencies at present obtained with electrical machinery.

4. If the electrical equipment could be purchased at reasonable prices, there are a few short lines of steam railroads on which the passenger traffic is such as to make electricity a possible form of motive power at present speeds.

5. It is probable that electric locomotives will be used in tunnels and for switching in cities where freedom from smoke is important.

6. No electric locomotive capable of doing the work of a medium weight steam locomotive has as as yet been constructed.

Twenty-sixth Convention of the Master Car Builders' Association.

(*Continued from page 448.*)

The second day's session was called to order June 16th, at 9:15 a. m.

A letter was read from the American Society of Railroad Superintendents, inviting the Master Car Builders' Association to send two or more delegates to the next meeting of the American Society of Railroad Superintendents, to take part in the discussion. The next meeting will be in New York, Oct. 20. On motion of Mr. Waitt, the President was authorized to appoint two or more delegates to attend to that Convention.

REPORT OF THE COMMITTEE ON METAL FOR BRAKE SHOES.

"Owing to the fact that the Committee has had another subject assigned to it, and, deeming the consideration of the subject of air brakes the more important of the two, when it came to live matters, they found they had consumed all the time, and regret much to have to appear before you without having made any progress over last year's work. We believe that last year's work leaves the subject in good condition for investigation, and we therefore recommend that the present committee be discharged and the subject turned over to a new committee."

On motion of Mr. E. B. Wall the report was accepted and the committee discharged. The subject was turned over to a new committee.

FREIGHT CAR TRUCK FRAMES.

We received 43 replies to our circular, 33 of which favored the rigid over the swing bolster type of truck, 15 of the 33 were using the Fox steel pressed truck under from one to fifteen cars each, and so far they had given entire satisfaction, one member having one car with this truck under for 15 months in constant service and had not cost one cent for repairs of trucks.

All expressed themselves that the Fox truck possessed good points, but had not been long enough in use for any one to recommend it. In view of these facts, your committee would recommend that this work be carried to the succeeding year, as the time required to ascertain the merits and faults of the Fox solid steel pressed truck would be considerably more than one year.

GEO. F. WILSON, S. A. CRONE, W. S. MORRIS,
Committee.

On motion of Mr. F. D. Casanave the committee was continued for another year. About this report Mr. Godfrey W. Rhodes said: "The committee have expressed themselves as unable to form any definite opinion about the Fox truck, but it does not seem to me that that was the main feature that they were appointed to investigate. I notice from last year's publication that the annual report contains a report upon the relative advantages of swinging and rigid bolsters. There surely has been plenty of time to get some information about them. There have been interesting discussions on that subject, and I hope that next year the committee will give more attention perhaps to that feature of it and less to the Fox truck."

THE RULES OF INTERCHANGE.

On motion of J. M. Barr the rules were read separately and the recommendations acted upon in the order in which they were read. The decisions of the Arbitration Committee for the past year were approved.

Mr. A. M. Waitt presented a report of the Committee on Joint Inspection and then the recommended changes in the rules of interchange were considered. The following are the changes decided upon without much discussion.

Rule 3, section (s), paragraph 13, changed to read "Brake wheels must be free from any defect."

Rule 3, section (s), paragraph 19, to be changed in accordance with the decisions reached by the association in considering the air brake and signal instructions.

Rule 3, section (t), paragraph 1, changed to read "Running boards complete and in proper place and securely fastened to roof of car."

Rule 3, section (u), paragraph 1, changed to read "Running boards complete and in proper place and securely fastened to roof of car."

Rule 3, section (u), paragraph 1, changed to read "M. C. B. couplers with such minor defects only as do not impair their efficiency in safety. The following defects will not be considered as impairing the efficiency of M. C. B. couplers."

A. Chipped to 1⅛ in. vertically, and 2⅛ in. horizontally from outer edge of guard arm, provided not less than 5 in. of metal is left intact on outer edge of guard arm at *A*. See fig. 1.

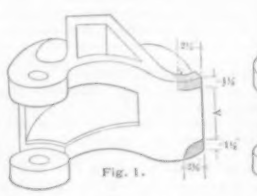


Fig. 1.

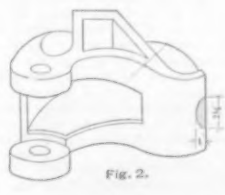


Fig. 2.

B. Chipped to 2⅛ in. vertically and 1 in. horizontally in centre of guard arm, provided both top and bottom corners are perfect. See fig. 2.

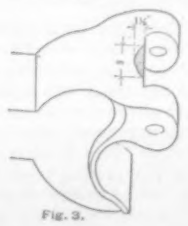


Fig. 3.

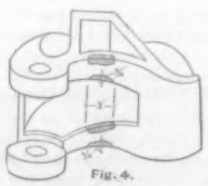


Fig. 4.

C. Chipped on side wall to 3 in. vertically and 1½ in. horizontally, as shown in fig. 3.

D. Chipped on front wall or centre front face to 3 in. horizontally and ¾ in. vertically in top, bottom and throat, as shown in fig. 4.

E. Chipped on lugs in which knuckle swings to ½ in. vertically, 3 in. back, and 3 in. transversely, as shown in fig. 5.

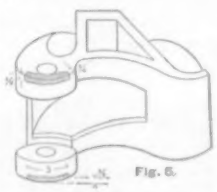


Fig. 5.

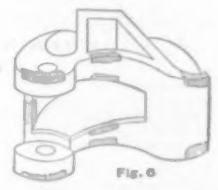


Fig. 6

F. Having combination of chipped places within limits given above, as shown in figs. 6 and 7, provided that defects shown in figs. 1 and 2 do not together exist in the same coupler.

G. Having rib in front of locking dog bent inward, provided rib is chipped off so as to allow dog to drop into position.

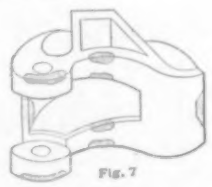


Fig. 7

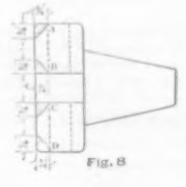


Fig. 8

D. Chipped on front wall or centre front face to 3 in. horizontally and ¾ in. vertically in top, bottom and throat, as shown in fig. 4.

Rule 3, Section (u), Paragraph 5, changed to read "Drawbar keys and followers must be sound, keys secured by collar or ring, and followers held in proper place by drawbar guides."

Rule 3, Section (u), a new paragraph, numbered 10, is added, as follows: "Any railroad company may refuse to accept a car when equipped with vertical plane couplers having either cast iron or malleable iron knuckles."

Rule 3, Section (y-2), changed to read "Cars with four hole centre plates and long centre pins through bolster unless two of these bolts are effective."

Rule 3, Section (y-3), changed to read "Cars with four hole centre plates and short centre pins which rest in upper plate unless three of the bolts are effective."

Rule 3, Section (y-4) changed to read "Cars with two-hole centre plates unless both bolts are effective."

Rule 3, Section (y-5) changed to read "Cars with two-hole centre plates if centre plate is broken."

Rule 3, Section (y-6) is removed, it being covered by (y 5).

Rule 4 has received the two following explanatory notes.

(1). A car is not to be considered unsafe to run on account of its not being safe to load with *any* kind of freight provided that it is safe for the freight that is in it at the time."

(2). Duplicate defect card shall be issued in the place of lost cards or illegible cards where the record at the interchange point shows that the cards were on the car when the cars were transferred from one road to another.

Rule 5, standard defect card, is to be changed by adding to the printed matter on the card at the top and over the name of the road the words "M. C. B. Defect Card."

Rule 6, changed to read "Any company finding a car with defect card attached may make the repairs by the card, provided such repairs are necessary for the safe running of the car, and render bill for same to the company attaching card, stating upon the bill the date and place where the repairs were made. But no bill is to be rendered unless repairs have been made. Cards are not to be removed from car until repairs are made and bill to stipulate the date and place when and where the repairs have been made.

Rule 8 is changed considerably on recommendation of the Arbitration Committee. The following is rule 8 as it now stands:

"Car owners shall be responsible, but not chargeable, except on defect card or as provided in rule 10, for the following defects, when they do not give evidence of recent origin, or of being caused by derailment or wreck, or by unusually rough handling:

"(*a*) Roofs lost from cars on account of decayed condition or faulty construction, and owners notified before the repairs are made.

"(*b*) 1. Brake shoes worn out.

"2. Journal bearings worn out.

"No charge is to be made for the labor of renewing; and an arbitrary scrap credit shall be allowed of one-half of the weight of the bearing applied.

"3. Truck bolsters broken or cracked.
"4. Body bolsters broken or cracked.
"5. Spring planks broken or cracked.
"6. Truck springs broken or cracked.
"7. Running boards defective.
"8. Roof boards loose or missing, or tin or iron roof loose.
"9. Roof grab irons loose or missing.
"10. End or side sheathing loose.
"11. End or side finish loose or missing.
"12. Ends or sides bulged (not broken).
"13. Corner plates cracked.
"14. Draft springs broken.
"15. Draft timber bolts broken.
"16. Centre plates broken.
"17. Centre plate bolts broken.
"18. Bolster guide bars broken.
"19. Bolster guide blocks broken.
"20. Truck truss rods broken or missing.
"21. Body truss rods broken or missing.
"22 Centre pins broken or missing.
"23. Pedestals cracked.
"24. Oil box covers missing or broken.
"25. Spread trucks.
"26. Loose dead blocks.
"27. Cars low on trucks where wheels come in contact with intermediate timbers.
"28. Brakebeams broken, except where caused by derailment or collision.
"29. Side bearings and bolts broken.
"30. Arch bars broken or cracked.
"31 Column bolts broken.
"32. Decayed timber.
"33. Leaky roofs."

"(*d*) Truck or body bolsters, or spring planks, or truck springs broken, provided that the car was not derailed or wrecked.

(e) Wheels and axles worn out as provided in Rule 9."

Rule 12 was changed in the matter of prices to be charged for axles as follows:

	New.	Second-hand.	Scrap.
One axle, 60,000 lbs	$10.00	$6.00	$4.00
One axle, 40,000 lbs	9.00	6.00	3.50

Prices of wheels to remain unchanged.

Rule 13, the form of bills for wheel and axle work is changed so that the columns formerly headed "number" is now headed "number of axles" and "number of wheels" and a new column is added under the section of "wheels or axles applied" headed "shop marks on wheels and axles."

Rule 16 has an addition as follows:

"When M. C. B. couplers of another make are placed upon a car the uncoupling arrangements shall be made operative, and when the attachments at the rear end of the coupler or the uncoupling arrangements are changed a defect card shall be applied to the car for the wrong parts used in such attachments and uncoupling arrangements."

Rule 19 had the following addition:

"In case of a foreign drawbar credited and removed a card shall be given for the full value of the drawbar as new material at the price given in Rule 26."

Rule 23 has the following changes:

Section 1, Box car, eight wheel, 34 ft. long or over, but under 36 ft., $325.

Section 4, Stock car, eight wheel, 34 ft. or over, $275.

Section 6, Stock cars with feeding attachments, add to the above figures per car $20.

Section 7, Stock car, with watering attachments, add to the above figures $20.

A note has been added to this rule after the prices of bodies as follows:

NOTE.—The lengths of cars above mentioned refer to the lengths over all of the car bodies, except in the case of flat cars, which have no bodies, in which case the lengths referred to is the length over end sills.

The paragraph at the top of page 22, Rules of Interchange, is changed to read:

"When cars of 60,000 lbs. capacity or over have trucks with journals 4 in. or over in diameter when new, $25 per car shall be added to the figures as given above for the values of car bodies."

Rule 25 is amended to read:

"Railroad companies shall promptly furnish to each other upon request, and forward free to their own road, material for repairs which cannot be procured in the open market."

Rule 26 has several changes as follows:

Malleable iron, four cents instead of five cents per pound. The words "not springs" to be inserted after words "spring steel." "Brass journal bearings to be charged at the rate of 14 instead of 16 cents per pound." Phosphor bronze bearings to be charged at 16 instead of 18 cents, the credit for scrap to be nine cents instead of ten cents per pound. In addition to the timber mentioned in this rule there now is included other kinds as follows; poplar, hickory and elm.

Added to the list of material in this rule there is now "ventilating side door $8." Added to this rule at the end without further change is the following about the allowance for labor.

"The following table shows the number of hours which may be charged for labor in doing the various items of work enumerated, which include all work necessary to complete each item of repairs, except so far as labor is already included in charges for materials."

	Refrigerator cars.	All other cars.
1 side sill, replaced	44	38
2 " sills, "	65	53
1 " sill and 1 intermediate sill, replaced.	50	41
1 " " 2 " sills, "	60	50
2 " " 1 " sill, "	72	58
2 " " 2 " sills, "	81	63
1 centre sill, replaced	44	40
2 " sills, "	70	54
1 side sill and 1 centre sill, replaced	70	54
1 " " 2 " " "	93	79
2 " " 1 " " "	77	60
2 " " 2 " " "	104	83
1 inter. sill, replaced	40	29
2 " sills, replaced	54	36
1 " sill and 1 centre sill, replaced	65	48
1 " " " 2 " sills, "	78	61
2 " sills, " 1 " sill, "	71	53
2 " " " 2 " sills, "	88	66
1 side sill, 1 intermediate sill and 1 centre sill, replaced	79	61
2 side sills, 1 intermediate sill and 1 centre sill, replaced	100	75
1 side sill, 2 intermediate sills and 1 centre sill, replaced	92	67
2 side sills, 2 intermediate sills and 1 centre sill, replaced	107	81
1 side sill, 1 intermediate sill and 2 centre sills, replaced	93	71
2 side sills, 1 intermediate sill and 2 centre sills, replaced	110	89
1 side sill, 2 intermediate sills and 2 centre sills, replaced	103	81
2 side sills, 2 intermediate sills and 2 centre sills, replaced	120	94
1 side sill, spliced	15	12
1 int " "	14	11
1 side plate, replaced	42	42
1 running board, replaced	6	6
1 end plate "	14	14
1 " sill under siding replaced	15	15
1 " " outside " "	7	7
1 " or corner post "	3	3
1 door or side "	3	3
1 platform plank "	2	2
1 body bolster "	10	8
1 cross-tie timber "	3	3
1 draft timber "	6	6
2 " timbers on same end, replaced	10	10
1 carlin, replaced	..	2
1 truck bolster, replaced	10	10
1 spring plank "	10	10
1 truck bolster and 1 spring plank in same truck, replaced	12	12
1 brakebeam, replaced	2	2
1 drawbar "	2	2

Added to the above, when printed in the rules of interchange, will be a column giving the cost of the labor for the various items rated at 20 cents per hour.

On motion of Mr. Bronner, of the Michigan Central, an additional charge was ordered for couplers applied in Canada. A clause to this effect was added to Rule 26, as follows:

"The prices of M. C. B. couplers applied in Canada shall be at an advance of 30 per cent. over the market price of couplers applied in the United States."

On motion of Mr. E. B. Wall the rules were adopted as a whole with the foregoing changes, and on motion of Mr. Barr the passenger car rules were adopted as printed last year, with the addition of prices of axles the same as for freight cars.

The Nominating Committee submitted the following nominations for the ensuing year, with a recommendation that the Association should consider the propriety of passing a resolution making Presidents and Vice-Presidents ineligible after one year's service. No action was taken on this. On the following day these nominees were elected for the ensuing year:

President, E. W. Grieves.
First Vice-President, F. D. Casanave.
Second Vice-President, J. S. Lentz.
Third Vice-President, T. A. Bissell.
Treasurer, G. W. Demarest.
Executive Committee, J. T. Chamberlain, G. W. Rhodes, P. Leeds, J. C. Barber.
Secretary, John W. Cloud.

THIRD DAY'S SESSION.

The Rules of Interchange were considered in the morning and the results are given in what precedes, together with the changes made in these rules during the second day's session.

Mr. Casanave called attention to the fact that the time fixed for the work of the Association is now but three days, and a longer period is needed for the work. Several members expressed the same opinion and it was voted that the President should appoint a committee of three to report the necessary changes in the by-laws to increase the duration of meeting of the Association. This committee reported in the afternoon with the following recommendation, which was adopted by the Association: "That the regular time of meeting of this Association shall be annually on the second Tuesday in June, and that the regular hours of the session shall be from 9:30 a. m. to 1:30 p. m. and from 2:30 p.m. to 5 p.m."

SUPPLEMENTARY REPORT OF COMMITTEE ON AIR BRAKE AND SIGNAL INSTRUCTIONS.

The Air Brake and Signal Instructions, which have now been put before the members of the Association with the recommendation of the Association that the rules be put in operation this year and be printed by the Association and placed on sale, are practically the same as presented last year, with which our readers are familiar. The following recommendations by the supplementary committee, which were adopted by the Association, will constitute the principal changes to be made in the Air Brake and Signal Instructions before they are issued in printed form by the Association.

I. Since it has been shown that the packing ring of the piston in the engineer's brake valve is, in some cases, sufficiently tight to prevent an accompanying reduction of pressure in the chamber to which the air gauge is attached, when the train pipe pressure is reduced by leaks, it does not appear to be safe to rely upon the test recommended in the fourth paragraph on page 6 of the report. It is also shown that, in engineer's brake valves having an excess pressure valve, air from the main reservoir might, under some circumstances, leak past the excess pressure valve sufficiently to compensate for the loss from leaks in the train pipe, if the test were made with the handle in the running position, as has been suggested. Such a compensation is certain to occur with engineer's brake valves of the most recent construction, in which the excess pressure valve has been replaced by a reducing valve. Such a method of testing for train pipe leaks is, therefore, unsafe.

It appears to the Committee that the only reliable method of determining the existence of dangerous train-pipe leaks by the engineman is to entirely disconnect the train pipe from the main reservoir, by placing the handle of the brake valve in the lap position, and to place an additional gauge in the cab, connected to the train pipe.

We therefore recommend the use of such an additional gauge, and the fourth paragraph of page 6 be amended so that it shall read as follows:

"When coupled to the train place the handle in the release position, and leave it there until the train-pipe pressure has reached 70 lbs. Then place the handle in position 3 and note whether the pointer of the gauge directly attached to the train pipe remains stationary or falls back. If the pointer falls back, etc."

If this recommendation shall not prove acceptable to you, the Committee believes that, while a test for leakage is very important, it would be better to omit it altogether than to require one which may be ineffectual, and in the event of the rejection of the above recommendation, we recommend that the fourth paragraph of page 6 be omitted entirely, and the paragraph next following it be amended so that it will read as follows:

"When the locomotive has been coupled to the train and the brakes have been charged with an air pressure of 70 lbs., the engineman shall, at a signal from the inspector or trainman, apply the brakes, and leave them so applied, etc."

An amendment, corresponding to that adopted for this leakage test, will also be necessary in the answer to question 78 of the catechism.

II. We recommend that the sentence in italics, in the fifth paragraph of page 6, be amended by striking out the last two words, "heavy grades," and inserting in their stead the words, "such grades as may be designated by special instructions."

This will make the testing of brakes before descending grades subject to the same conditions as those which regulate the use of the pressure retaining valves upon page 12.

The adoption of this amendment will necessitate a similar change in the first paragraph of page 10, and in answer to question 53. Question 112 should then also be amended to read as follows:

"How should you proceed to test the air brakes before starting out, after a change in the make-up of a train, or before descending certain specially designated grades?"

III. Your Committee begs to offer one other recommendation. Since it appears to many to be desirable to designate not only maximum and minimum limits of brake piston travel to guide inspectors as to the extent to which the brake shoe slack must be taken up, but also a limit to which the piston travel may be allowed to increase before an adjustment is again required, we offer for your consideration the following amendment to the clause concerning the adjustment of brakes, beginning at the bottom of page 14: We recommend that the last sentence of this clause, in the first paragraph of page 15, be stricken out and that the portion of the clause remaining be prefaced with the following:

"When under a full application the brake piston travel is found to exceed 8 in. upon a passenger car or 9 in. upon a freight car, the brakeshoe slack must be taken up and the adjustment so made that the piston shall travel not less than 5 nor more than 6 in."

Changes corresponding to your determination respecting the adjustment of brakes should also be made in the first paragraph of page 6, in the clause relating to adjustment upon page 13 and in the answers to questions 56, 111, 112 and 131."

CAST-IRON WHEELS.

A circular was sent to wheelmakers and heads of car departments represented in the Association, embracing the following 11 questions:

First. Do you use what is known as the "contracting chill," what percentage of your product is made in such chills and whose design of contracting chill do you use?

Second. Do your records show that there is any advantage in using the contracting chill, either in percentage of loss or uniformity and quality of product?

Third. Do you find that cheaper grades of iron may be used in wheels made in the contracting chill with as good results as with more expensive grades of iron in solid chills?

Fourth. What percentages of new iron do you find it desirable to use in making wheels in the contracting chill and in the solid chill?

Fifth. Has the percentage of guaranteed wheels which you have been required to replace, or to have replaced, been modified by the use of the contracting chill in the manufacture of such guaranteed wheels, and to what extent?

Sixth. Do you grind or balance wheels before you ship them to the purchaser, or before you put them in service?

Seventh. In case you grind or balance the wheels, has the percentage of wheels which you have been required to replace or to have replaced been reduced by the grinding or balancing, and to what extent?

Eighth. What is your wheel guarantee?

Ninth. What variations are allowed in weight and in circumference of wheels of the same nominal weight or diameter?

Tenth. How long are wheels permitted to remain in the annealing pits?

Eleventh. What do you consider the proper depth and distribution of the chill on a wheel?

Replies were received from 16 railroads and 13 wheelmakers.

First. Of the 16 roads making replies, 11 are using wheels cast in contracting chill, two in the plain chill, and three made no reply to this question. Of those using the contracting chill, one used the Canda, one the Whitney, and nine the Barr. Of the 13 wheelmakers, five are using, and one arranging to use, the Barr chill, one the Whitney, one the non-expansive chill and five the plain chill.

Second. Of those using the contracting chill and its products, all agree, with one exception, that foundry loss is decreased; some place it as high as 50 per cent. The one exception is a road that was noted for its success with cast-iron wheels before the introduction of contracting chill. It is the opinion of your committee that the evidence at hand goes to prove an advantage in this respect. As regards uniformity and quality of product, nothing definite can be said by the committee.

Third. As regards using a cheaper grade of iron with contracting chill, out of the twenty-nine answers to the circular, eleven made no reply to this question; three answered that cheaper iron might be used; one was doubtful; five answered no; seven thought it not advisable to do so, and two had no data.

Fourth. It is the opinion of your committee that not less than 50 per cent. of new iron should enter into the manufacture of cast wheels.

Fifth. It is clearly evident that users of cast-iron wheels have not had sufficient experience to warrant a very general reply to this question, and it is one that might be a fit subject for further inquiry.

Sixth. Eight of the 29 replies received failed to answer this question, which, in the opinion of your committee, is one of the most important questions: seventeen grind all or part of their wheels, four neither grind nor balance their wheels.

Eighth. We find the general guarantee is four to five years in freight service and 60,000 miles in passenger service. A very notable feature of the report is that parties advocating 25 to 40 per cent. of new iron only guarantee their wheels for three years in freight service, while those using 75 per cent. of the new iron guarantee them for five years in freight service, or for 70,000 miles in passenger service.

Ninth, It is evident, from the answers received, that all did not understand this question alike, as the weights vary from 5 to 29 lbs., and the circumference from 0 to 2¼ in.

Tenth. Answers to this question are somewhat surprising. The time allowed in the annealing pit varies from three to nine days, and it seems as though a more uniform practice might be followed to good advantage, for, if three days be sufficient to properly anneal a wheel, the practice of allowing them to remain from six to nine days must be a very expensive one in the foundry, and if from six to nine days be necessary to make a good wheel the practice of annealing only three days ought to be corrected. Advocates of the maximum or minimum time are not confined to plain or contracting chill, and it appears to be either a question of opinion or circumstances.

Eleventh. From the replies received the committee finds that the practice varies from ⅜ to ¾ on tread, and ¼ to ⅝ in throat.

A few points raised by advocates of the contracting chill will not be out of place. One of the largest makers and users of wheels says he expects decided gains by the use of the contracting chill, as wheels may be ground with safety, after being slid flat, and used again, on account of the extra deep chill. Another says 4½ per cent. of wheels cast in plain chill were condemned on account of chill cracks and other defects not known in the contracting chill.

One wheel manufacturer says wheels cast in contracting chill do not vary ¼ in. in circumference, another says ⅝, another says without hardening our mixture we obtain, in at least 90 per cent. of our wheels, a chill of ⅝ to ¼ in. deep, uniformly all around the wheel at the root of the flange, while the same mixture if cast in the solid chill would have no chill at all or it would be very slight. It is said that specific gravity tests of white iron produced in the contracting chill, show from one to three pounds greater weight per cubic foot than same iron from the plain chill.

One of the plain chill advocates makes a very forcible remark and one worthy of consideration, namely, "that the contracting chill is a much heavier one than the plain chill of five or eight years ago." His experience, which is large, confirms his belief that the plain chill of same weight as the contracting chill, and the same material, in the hands of skillful and experienced men, will produce equally as good results as the contracting chill. This is also confirmed by two other large manufacturers, who have verified statements that this experiment has been made to their entire satisfaction, and who further claim that the time between pouring and chilling the iron is very little affected by any contracting chill, and conclude by saying, "If railroads will first specify everything possible, so they can upon inspection: 1st, be sure of a safe wheel; 2d, that it will indicate sufficient chill; 3d, that it is mechanically correct and not liable to damage from rough riding, flange wear, etc., and ask the maker to guarantee certain mileage, and let them (the makers) provide the wheel, the railroads certainly would be getting all they could ask for."

GEO. W. WEST, W. H. THOMAS, JOHN PLAYER,
Committee.

Mr. F. D. Casanave said: This is a very good report and shows that this committee has been at work. It is valuable in so far as it calls attention to the claims made by different wheel makers who use different methods of making wheels, namely, the contracting chill and the wheel made in the ordinary chill. Claims are made by the advocates of the contracting chill that wheels so made have a chill very much more uniform in the depth of chill. It seems to me that the committee next year ought to endeavor to ascertain and give us the facts in support of such claims. If the claims made by the advocates of the contracting chill are true, we are wrong in buying the other wheels. If a wheel has seven-eighths of an inch chill at one point and only one-eighth at the opposite side, the value of that wheel is limited to the depth of one-eighth of an inch chill. The committee next year should get some facts by calling upon as many railroads as they chose to give as many wheels as are required to determine whether the average chill is greater or more uniform in wheels made in one kind of a chill or in the other. I would therefore move that the committee be continued for another year and in that time investigate the subject further and advise this convention whether wheels made by any particular method are better than others.

This report was received and the Committee continued for another year.

WHEEL GUARANTEE.

A meeting was held on April 6, 1892, at Chicago, of the Executive Committee of the Association of Chilled Cast Iron Wheel Makers, in which the following resolution was passed:

Resolved, "That when wheels are removed as failure wheels from service, for any cause whatever, where there is a doubt as to whether the wheel maker is responsible or not for the failure, if it is practicable, such wheels shall be tested by the Master Car Builder, or his representative, and if it is found that the depth and character of the chill, and the strength and character of the metal in the plates, are up to the standard specifications adopted by the Joint Conference Committee of the American Railway Master Mechanics, Master Car Builders and the Wheel Makers' Association, it shall be considered that failure is due to the service and not the quality of the wheel, and that the wheel maker ought not to be called upon in such cases to pay for or replace any such wheels."

Your Committee feels that the resolution as passed is indefinite in its character, and is somewhat one sided in favor of the wheel maker.

In the first place the clause, "where there is a doubt as to whether the wheel maker is responsible or not for the failure," is extremely indefinite. Rule No. 9 of the M. C. B. Rules of Interchange reads as follows: "When wheels or axles are renewed they shall be treated as follows:

"Wheels shall be charged to the company owning the car, if the cause of removal is: (a) Shelled out spots; (b) seams; (c) worn through chill; (d) worn flange; (e) tread worn hollow; (f) burst; (g) broken flange, if the breakage is caused by seams worn through chill or worn flange; (h) broken rim, if caused by rim being hollow; (i) cracked tread, caused by being worn through chill; (j) cracked plate; (k) cracked brackets; (l) broken in pieces; (m) loose; (n) out of gauge. Wheels shall not be charged to the company owning the car if the cause of removal is: (a) Flat sliding; (b) chipped flange; (c) broken flange, if the breakage is not caused by seams, worn through chill or worn flange; (d) broken or chipped rim, not caused by rim being hollow; (e) breakage of any kind caused by derailment. This rule clearly specifies the defects for which the owner is responsible, or the user is responsible, as between railroads."

All the defects common to wheels are enumerated here, with the exception, perhaps, of wheels failing on account of being "comby," and the defects as mentioned are carefully defined under Rule No. 3, Sections (a) to (n), inclusive. The defect called "comby" is of rather rare occurrence, being an irregular spot caused by collection of dirt or slag in the tread of the wheel.

With reference to the defects enumerated above, the wheel maker certainly is not responsible for wheels "loose" or "out of gauge," although the railroad company mounting and using the wheels should be responsible.

There might also be a question as to the responsibility of the wheel maker for "burst wheels," as the bursting may have been caused by undue pressure in mounting on the axle or from bad fitting. In the case of "burst wheels," the breakage of the wheel in question and the inspection of the strength and character of the metal in the plates might be a basis for an expert to determine the responsibility of the wheel maker, but it would be a somewhat difficult matter for master car-builders to determine this question satisfactorily to themselves and to the maker.

With reference to the defects, "shelled out," "comby," "seams," "worn flange," "tread worn hollow," an inspection of the "depth and character of the chill, and the strength and character of the metal in the plates" would throw no light whatever upon the subject, as there is no relation between these defects and the points referred to by the Wheel Makers' Association.

The remaining defects, mentioned in clauses from "g" to "l" inclusive, are all cases of fracture, and it is the opinion of your Committee that wheel makers should, under no circumstances, be relieved from responsibility for any of the cases of breakage referred to therein.

In the matter of worn flanges, there is a series question as to whether wheel makers should be held responsible for all cases of failure from this cause, as a portion of such failures may be due to trucks out of shape and improper fitting; at the same time the result of our observations would seem to indicate very decidedly that the formation of worn flanges is due to a very great extent to difference in the wearing quality of the two wheels.

As recommended in a previous report it would possibly be fair to hold wheel makers responsible for half of the failures from worn flanges. The members of the Wheel Makers' Association presented quite a number of examples of wheels which were considered subject to replacement by the railroad company, in which the defect consisted of "rough spots caused by sliding," and it would seem from their testimony that a great many railroads do not distinguish between "rough spots formed by sliding" and "shelled out" or "comby" wheels. This certainly is not fair to the wheel maker, as the wheel is ruined by sliding and would have been a perfectly serviceable wheel if not unfairly treated by the railroad company in this respect. Sliding a wheel frequently heats it to such an extent as to crack the brittle white iron, causing small pieces to flake off, and this seems to be more frequently the case in well chilled wheels than in poor ones, the white iron possibly being harder. In the opinion of your Committee wheel makers should certainly not be held responsible for this defect.

In conclusion, it is the opinion of your Committee that the resolution adopted by the Association of Chilled Cast Iron Wheel Makers cannot be incorporated in the specifications adopted by this Association, and that the only points which the Committee has to recommend for the consideration of the Association, so far as changing the present specifications is concerned, is whether any allowance should be made to the wheel maker for "worn flanges." As to the wheel maker's responsibility for wheels sliding: when the sliding causes a "flaking out" on the tread, generally known as "comby from sliding," it would be impossible to incorporate this in the specifications, the matter being a question of judgment as to the cause of the spot so failing. It would possibly make the matter more definite to change the term "flat by sliding" as used in the guarantee, to "flat by sliding or comby by sliding." J. J. HENNESSEY,
THOMAS SUTHERLAND,
Committee.

Mr. Rhodes said: Last year there was action taken unfavorable to the wheel makers. This is the action that comes up now. I want to call the attention of the Association to the good work that these specifications and standards of our Association are accomplishing. The standards adopted for wheel guarantees and tests for wheels have, I think, raised the quality of the cast iron wheel all over the country. Manufacturers generally are helping in this direction—not only with wheels, but with couplers and air brakes. About a year ago we started to buy wheels according to the M. C. B. requirement, and it was quite astonishing how bad the wheels were. But now it is a very rare thing to find a wheel that will not stand the tests.

The recommendations of this report were ordered to be submitted for letter ballot.

STEEL-TIRED CAR WHEELS.

Your Committee regrets that, on account of its inability to get sufficiently definite information, either from members of the Association or manufacturers of steel-tired wheels, it is unable to submit any data that can be considered satisfactory or conclusive. Returns received from twenty eight lines representing 12,423 passenger equipment cars of the 30,659, given by Poor as the total equipment in the United States and Canada in 1891, show that they have used, approximately, the following steel-tired wheels:

Type of centre.	Make.	Number of wheels.
Bolted centres	Allen	14,618
	Allston	16
	Boies	2,487
	Krupp	260
	Paige	1,876
	Snow	1,234
	Total	20,491
Solid wrought spoke	Arbel	404
	Brunswick	1,354
	Krupp	80
	Total	1,838
Solid wrought disc	Krupp	924
	Total	924
Solid cast	Snow (boltless)	80
	Washburn	1,673
	Total	1,753
	Grand total	25,006

Defects of centres have been reported in tangible shape only in a few instances; the most of the defects given relating to the tires and not to the centres, and it would seem that the records kept by many do not enable them to trace, accurately, the latter. The information before your committee, however, shows that none of the bolted centres reported are entirely exempt from trouble with loose bolts. The maximum variation in weights of the different types of centres is about 200 lbs. for wheels 33 in. in diameter; the solid wrought spoke centres being the lightest and the solid cast centres the heaviest, the bolted centres and the solid wrought disc centres varying between these two.

R. E. MARSHALL, C. H. CORY, J. O. PATTEE,
Committee.

The report was accepted and the committee continued.

AUTOMATIC COUPLER STANDARDS AND LIMITS.

First.—For the preservation of the contour lines and the thickness of knuckle the committee recommends the gauges proposed by the Executive Committee in their announcement of September, 1891, together with the limits of variation allowed by these gauges. It is difficult to compare the gauges for contour lines submitted in the report of the Executive Committee to the convention of 1891, and accepted by that convention, with the revised gauges offered in the announcement of the Executive Committee dated September, 1891, nor have the limits of variation proposed to the convention been strictly adhered to in the revised limit gauges, either for the contour lines or for the measurement of the knuckle. The revised gauges and the new location of ruling points not only preserve the contour lines, but will also render it impossible to make any local change in the contour lines which would prevent the interchange of couplers of the M. C. B. type. The committee are therefore unanimous in recommending the adoption of the gauges submitted to the association in September, 1891, by the executive committee, pursuant to the instructions given them at the convention of 1891. It has been ascertained that the allowable limits of variation from the standard lines are sufficient to cause no difficulty in the manufacture of the couplers.

Second.—The committee recommends the adoption of the limits for standard rectilinear measurements as given in the table with fig. 3 of the September report of the Executive Committee. In recommending these measurements your committee considers it proper to call attention to dimensions "D," that is, the width and depth of the shank immediately behind the head of the coupler and the advisability of increasing the width. Your committee finds, after careful investigation, that the most serious failure of couplers takes place in the guard arm. Increasing the width at this point will admit of strengthening the guard arm and will also provide additional strength to prevent pulling off the head of the coupler. A failure of this kind usually permits the head of the coupler to fall upon the track with occasionally disastrous results. Various devices have been adopted to prevent the coupler from falling upon the track in case of the failure of the end fastening, but no means has as yet been provided, so far as we know, to prevent the head from falling upon the track when it becomes broken from the shank of the coupler.

Third.—The committee recommends the adoption of a standard method by the Association for operating the locking devices of the M. C. B. couplers.

Fourth.—The committee recommends the adoption of a more secure fastening than the tail bolt for automatic couplers; the "U" shaped, or pocket, fastening seems to offer a very much more secure and efficient device for this purpose.

Certain prescribed tests were formulated, and a general invitation was issued to all manufacturers of vertical plane couplers to meet the committee not only for the purpose of securing uniformity in the M. C. B. standards, but also to settle upon a standard of excellence in material and design. The tests to which couplers should be subjected were willingly agreed to by a large majority of the manufacturers present, and your committee therefore submits the following specifications for your consideration:

Specifications for M. C. B. Drawbars.

1. WEIGHT.—Drawbars, including knuckles and locking attachments, should weigh 210 lbs. or less; they must not weigh over 220 lbs.

2. DROP TEST.—*Description.* All drop tests will be made on a solid masonry foundation 4 ft. × 4 ft. × 4 ft. In testing drawbars for buffing blows they shall be placed in a vertical position, the shank resting upon the foundation and with the knuckle in its locked position. The bottom of the drop will be flat so as to represent the blows from an opposing M. C. B. drawbar.

3. PULLING TEST.—Drawbars, when subjected to this test, must stand a pull of not less than 100,000 lbs. A draft bolt or stirrup must be attached to the drawbar and subjected to the same pull, so as to strain not only the knuckle and locking device, but also the end of the shank of the coupler.

4. DROP TEST.—Drawbars must stand the following drop test:

Weight of drop, 1,640 lbs.
Three blows at 10 ft.
Two blows at 15 ft.

The drawbar or knuckle must break into two or more pieces before it is considered to have failed under this test. The cracking of the parts will not be considered as a failure.

5. In testing drawbars, if the knuckles fail and the bars stand the test, the bars will be accepted if satisfactory knuckles are provided, or if the bars fail and the knuckles stand, the knuckles will be accepted if satisfactory bars are supplied.

Your committee also recommends that additional tests should be provided for the following, although we have as yet been unable to unite on any definite recommendations:

1. Guard arm tests.
2. A drop test to represent the shock to which couplers are subjected in pulling.
3. Tests to determine the resistance of the coupler to distortion within the limits of the gauges.

Your committee does not advise that the above tests be acted upon at this meeting, for the reason that their recommendations are largely speculative, but they do recommend that they be accepted provisionally and that final action be taken one year hence. To further a proper consideration of this matter we also recommend that the Executive Committee of the Association should consider the advisability of calling for a laboratory test of couplers to be held sometime during the month of October or November.

J. S. LENTZ, G. W. RHODES, J. M. WALLIS,
Committee.

This report was accepted and the committee continued. The adoption of the gauges submitted to the Association last September by the Executive Committee was referred to letter ballot.

On motion of Mr. Forsythe, the recommendation and the report relating to the dimension of the barrel of the coupler was approved provisionally for the coming year. On motion of Mr. Schroyer the recommendation about the standard unlocking device was accepted and a committee was ordered to be appointed for its consideration during the coming year.

On motion of J. M. Barr it was voted to be the sense of this convention "That the specification for M. C. B. couplers, as presented by this committee, be provisionally adopted and acted upon during the period between this and the convention next year."

On motion of Mr. Waitt, the recommendations about laboratory tests were referred to the Executive Committee.

STEAM HEAT AND VENTILATION OF PASSENGER EQUIPMENT CARS.

Heating cars by steam has, in the past year, made very little advance in methods, but a very decided advance in the number of cars equipped for this purpose. This would indicate that the present devices used for the purpose are reasonably satisfactory. The tendency in the past year to eliminate complications and refinements of design based on theoretical considerations as to what constitutes a perfect system of heating cars by steam is clearly apparent. For example, a temperature regulator has been abandoned on several large lines, not because the device is not desirable, nor because it did not perform its work satisfactorily when in order, but because better results were obtained by removing this complication, and making uniformity o

temperature dependent on the care and attention of the trainmen, as has been done heretofore with the Baker heater and the ordinary car stove. The idea of cutting off a portion of the radiating surface of the pipes within the car in mild weather has also been abandoned in some cases, not because the arrangement when in working order did not give very satisfactory results, but because the complication produced by the additional valves, etc., necessary to accomplish results, were found more objectionable than the advantages gained by their use.

The immediate and most important object of this committee is to consider the points involved in steam heating so far as they affect the matter of interchange of cars having different systems of heating or different steam connections or couplers. With this object in view the accompanying figs. 1, 2, 3 and 4, are presented fixing the following points:

1. Location and size of end of steam pipe.
2. Standard 45° elbow for end of steam pipe.
3. Standard hose nipple.
4. Standard steam hose.
5. Location of steam coupling.

It will be remembered that this association at its Twenty-fourth Annual Convention in 1891 adopted a standard for the end of steam pipes. At that time very little experience had been obtained in the matter and subsequent developments have made this standard useless. Your committee would therefore recommend its abandonment as we do not know of any case in which it is used to-day.

The adoption of items one, two and three as standard, or even of one and two, with the hose nipple of the proper size to fit the elbow, would afford means of promptly interchanging cars. At the same time it is considered advisable to fix the length at least of the steam hose and the location of the steam coupling in order to prevent interference with the air-brake coupling.

J. N. BARR, J. C. BARBER, W. H. LEWIS,
T. A. BISSELL, S. W. MARDEN, *Committee.*

Mr. Waitt said: It is a pleasure to have a report made where there is something definite and fixed as a recommendation, and I for one would heartily make the motion that we receive the report of the Committee, and that the recommendations that they have presented be submitted to letter ballot; also the question of abandoning the standard that was adopted two years ago, but which has not been used.

On motion of Mr. E. B. Wall the recommendations of the Committee were provisionally adopted for the coming year, and the Executive Committee was directed in publishing the report to eliminate all cuts and references to patented devices. The report received and the Committee discharged with thanks.

STANDARDS OF THE ASSOCIATION.

The present Standards of the Master Car Builders' Association are the result of their deliberations through a long period of years. Many of the earlier Standards were adopted when the Association was in its infancy, and there has been a great deal of legislation under the general heading of Standards, which has resulted in the acceptance and promulgation of certain forms of construction or forms of practice, which, in our judgment, ought never to have been classified as Standards. It is the opinion of the Committee, therefore, that what are now comprehended under the general category of Standards of the Association should be divided into two groups; the first group to be continued and maintained as the Standards of the Association; the other group to be rescinded as standards, but to be established as recommended practice. These two groups of subjects may be defined as follows:

Standards.—Those forms, parts, constructions, units, measurements or systems in which it is desirable to secure not only sound construction, good practice and safe operation, but which also promote quick and cheap repairs and consequent free interchange of cars.

Recommended Practice.—Those forms, parts, constructions, units, measurements or systems which are conducive of sound construction, good practice and safe operation, but which do not affect either interchangeability of parts or interchangeability of cars as a whole.

The present Standards of the Association would naturally group themselves under these revised headings as follows:

Standards.

WHEELS AND AXLES.

Section of Wheel Tread and Flange.
Wheel Circumference Measure.
Axles.
Gauge for Mounting Wheels.

JOURNAL BOXES AND CONTAINED PARTS.

Journal Boxes.
Journal Box Lids.
Journal Bearings and Wedges.

DRAW GEAR.

Vertical Plain Coupler.
Height of Drawbar.

BRAKE GEAR.

Brake Shoe and Head.
Iron Brake Beam.
Angle of Brake Lever.
Train Pipe Pressure (for Air Brake).
Percentage of Light Weight Braked (for Air Brake).
General Arrangement of Brake Levers (for Air Brake).
Details of Rods, Levers, etc. (for Air Brake).
Location of Dummy Couplings (for Air Brake).

MISCELLANEOUS.

Passenger Truck Pedestal.
Screw Threads.

RECOMMENDED PRACTICE.

Diameter of Chill Molds.
Specifications for Cast Iron Wheels.
Guarantee for Cast Iron Wheels.
Protection of Trainmen.
Truck Check Chains.
Capacity of Draw Spring.
Limit Gauges for Round Iron.
Loading Logs, Poles and Bark on Cars.
Marking Cars.
Dead Blocks.
Platform Safety Chains.
Lettering and Numbering Fast Freight Line Cars.

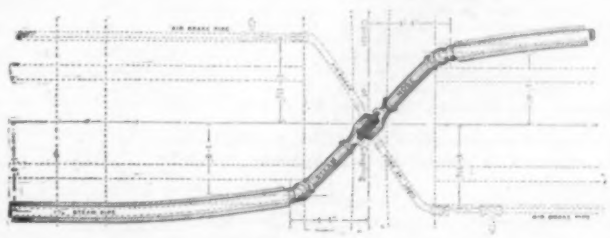


Fig. 1.—Plan.

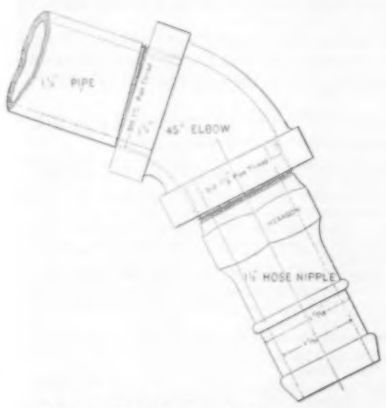


Fig. 2.—45° Elbow and Hose Nipple.

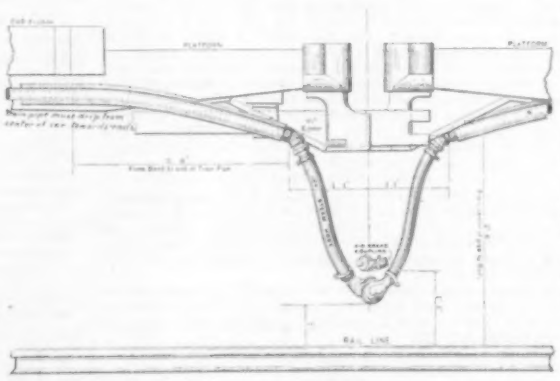


Fig. 3.—Side Elevation.

Proposed Standards for Steam Heating Couplings.

It is believed that the following, which are now classified under the head of Standards, do not properly belong either under the proposed classification of Standards or of Recommended Practice:

Storage of Line Cars on Foreign Roads,
Dictionary of Terms,
Entertainments.

The information embodied under these three headings should, of course, be properly recorded and should be reprinted in the proceedings from year to year.

It is believed that this limitation of the word "Standard" would inspire respect and would result in the more general observance of standards than now.

The Committee offer the following suggestions in reference to the present standards, if subdivided and grouped separately as standards and recommended practice:

Standards.

Section of wheel tread and flange: (Believed to be all right.)
Wheel circumference measure: (Believed to be all right.)
Axle: (The Committee is of the opinion that it would be expedient to submit to a special committee appointed for the purpose, the question of modifying the present light axle so as to make its journal 4 in. by 7 in., instead of 3¾ in. by 7 in., as now.)
Gauge for Mounting Wheels: (Believed to be all right.)
Journal Boxes: (It is suggested that the drawings of the present Standard journal boxes, if reproduced full size, should be very carefully revised, as there are evidences that the present drawings are not complete in every respect.)
Journal Box Lids: (The drawings should be revised together with the drawings of the journal boxes.)

This report is one of the best ever prepared for the Association; it only lacked conclusiveness from the fact that out of 287 members who might have replied to the circulars only 47 did reply. Of course this makes the percentage in the report rather indefinite. The argument of the committee about separating the so called standards, from what are more strictly speaking by-laws and recommended practice was very favorably accepted by the members. The following are extracts of the report, and lack of space alone forbids our publication of the complete report, copies of which can be obtained from the Secretary by those who desire to make a more detailed study of the work of the Committee:

Journal Bearings and Wedges: (The designs for these parts also need to be carefully redimensioned.)
Vertical Plane Couplers: (Believed to be all right.)
Height of Drawbars: (The indications are that standard height of 33 in. for freight equipment cars has not been adhered to, and that there is a tendency to increase this height. It would, therefore, seem well to have the facts reviewed by a special committee who should advise whether it was expedient to modify the standard height of drawbars for freight equipment cars.)
Brake Shoe and Head: (Believed to be all right.)
NOTE.—Plate V. in Proceedings of 1891 shows in "Section C. D." dimensions $\frac{7}{8}$ in. and 1¼ in., which should be respectively $\frac{5}{8}$ in. and $1\frac{1}{32}$ in., to conform with dimensions shown in other views. These figures will be corrected in next issue, as it is plainly an error.—SECRETARY.
Iron Brake Beam: (Plate XII. now shows the Westinghouse Iron Brake Beam in detail. It is suggested that the drawing should be revised to simply show the centre lines of a triangular brake beam, without showing any specific construction of brake beam, but distinctly showing the Christie Brake Head and Shoe in position; the distance from centre to centre of brake heads; the location of brake beam strut; the angle of the brake lever which passes through the strut, etc., etc.
Angle of the Brake Lever: (Believed to be all right.)
Train Pipe Pressure: (Believed to be all right.)
Percentage of Light Weight Braked: (Believed to be all right.)
General Arrangement of Brake Levers: (Believed to be all right.)
Details of Rods, Levers, etc.: (Believed to be all right.)
Location of Dummy Couplings: (Believed to be all right.)
Passenger Truck Pedestal: (It is possible that this Standard could be slightly modified so as to produce a more pleasing outline, and also so as to introduce a third bolt in the upper flange and thus accomplish more secure fastening to the truck side timber.)
Screw Threads: (Believed to be all right.)

Recommended Practice.

Dimension of Chill Molds: (Believed to be all right.)
Specifications for Cast Iron Wheels: (Believed to be all right.)
Protection of Trainmen: (It is suggested that this Standard should be carefully reconsidered and revised, with the idea of eliminating the dimensions of detail parts and confining the recommendations of practice for the Safety of Trainmen to a few general suggestions without restriction to certain dimensions. The present Standards are so widely departed from that it would seem prudent to reconsider them and bring them into closer average conformity with existing practice.)
Platform safety chains: (It is suggested that this standard should be revised as a recommended practice and made to relate only to the general use of platform safety chains without defining and requiring a specific construction.)
Truck check chains: (Believed to be all right.)
Capacity of draw springs: (Believed to be all right.)
Limit gauges for round iron: (Believed to be all right.)
Loading logs, poles and bark: (Believed to be all right.)
Marking cars: (The present standard relates only to the matter of spelling out in full the name of those railroads which have the same initials as one or more other railroads: but as it seems probable that the association may ultimately adopt a recommended practice in the matter of marking cars, it would seem to be advisable to perpetuate the present standard as a recommended practice in anticipation of further legislation.)
Lettering and Numbering Fast Freight Line Cars: (The indications being that the present standard system is not observed because it is not satisfactory to the managers of fast freight lines and the office of railroad companies who contribute cars to such fast freight lines, it is recommended that this standard should be given over for consideration to a special committee, with instructions to report a recommended practice after consultation with the Car Accountants' Association and with the managers of fast freight lines.)

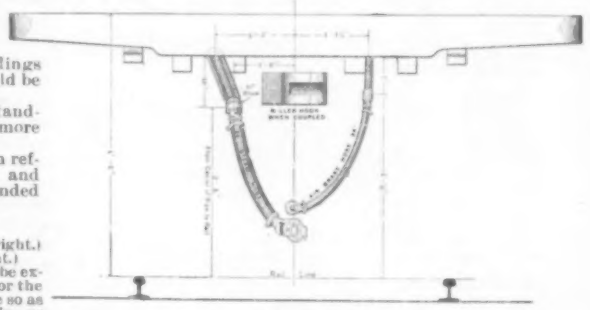


Fig. 4.—End Elevation.

It is the conviction of the committee that the method of publishing the Standards of the Association is susceptible of improvement, and it begs to suggest that hereafter the Standards and Recommended Practices of the Association shall be published in pamphlet form with references to lithographed drawings, the latter giving, when possible, full size illustrations of the various Standards and the various Recommended Practices. It is further suggested that these lithographed drawings should be uniform in size, and should be made on strong transparent paper, so that blue prints can be taken from them direct. The pamphlets and lithographed sheets of reduced size could be bound in the Annual Proceedings, as now; under which circumstances it would seem proper to make a moderate charge for such pamphlets and such full size lithographs (of Standards and Recommended Practices) as were issued to members or to others.

R. H. SOULE, Roanoke, Va. (Supt. Motive Power, N. & W. R. R.); E. CHAMBERLAIN, Buffalo, N. Y. (Master Car Builder, New York Central R. R.); WM. MCWOOD, Montreal, Canada (Asst. Mechanical Supt. Grand Trunk Ry.), *Committee.*

Mr. E. B. Wall said: I believe that the thanks of this convention are most surely due to this committee. This is one of the best reports that we have ever had, and I am very sorry that we have so little time now at our disposal to discuss it fully.

On Mr. Wall's motion, seconded by Mr. Barr, the subject was continued and made the first business for discussion at the next convention. The recommendations of the committee were referred to the Executive Committee with the authority to appoint such committees as it may think proper for the consideration of the recommendation.

STANDARDS OF EFFICIENCY FOR AIR BRAKES.

Developments in power brakes for high train service during the past year have again brought the subject of train brakes prominently before the railroads of this country. In 1887, as well as in 1886, the results of the brakes tested were such that they made specific recommendations impracticable, and even the following year, with every indication of one successful air brake in the field, and definite recommendation would hardly have been wise if even in keeping with the Constitution of the Master Car Builders' Association. Sufficient progress has been made in the art to materially alter these conditions. With the strong competition now prevailing in transportation, and the reduced profits in the business, there not only is, but will in the future be, a strong temptation to railroads and individual car owners to use devices which an intelligent investigation would condemn. The Master Car Builders' Association can aid very materially in providing against such difficulties by establishing standards of efficiency to which the devices shall be subjected before they obtain the official approval of the association. . . . Your committee is in correspondence with nine different air brake companies, and that in several instances these represent more than one style of triple. The brake question has always been a complex one, and it is difficult for those best posted in the matter to draw accurate conclusions unless the devices are tested on a rack under identical conditions or in

actual service. Air brakes have been put on the market and sold which lack some of the most essential features of an effective brake. As a matter of fact, manufacturers have not only deceived themselves, but deceived their patrons, and this, notwithstanding the closest investigation having been made by all parties. The best experts in the country have been unable to detect from an examination of models and drawings whether essential features, such as quick action, graduation, etc., existed or did not exist. Public opinion and general knowledge of the subject will effectively keep out the further introduction of independent brakes which were making such headway prior to your 1886 and 1887 investigation. There is, however, no board of censorship or test to keep out impracticable air brakes, or to establish which of the new devices are really meritorious. It would seem a fitting time then for the association to be considering a series of requirements which shall be exacted from all air brakes prior to their receiving the indorsement of the association.

With the above in view, your committee, after holding several meetings and receiving much valuable assistance from the brake companies, as well as those interested in the brake question, has drafted the following requirements:

Proposed Standard of Efficiency of Air Brakes.

Conditions of Tests.

First. Brakes will be tested on a rack representing the piping of a fifty 34 ft. car train. All cocks, screens, angles and connections will be as nearly as possible identical with those in train service. The rack shall conform to the drawing, fig. 1, which gives the proper fittings, piping, dimensions of cylinder, auxiliary reservoirs, main reservoirs, engineer's valve etc. (*Fig 1 not ready on going to print.*)

Second. PRESSURE.—Tests will be made with a uniform train pipe pressure of 70 lbs.

Third. CONSTRUCTION OF TRIPLES.—Triples must be constructed so that they can be secured and operated on apparatus conforming to diagram, fig. 2. (*Fig. 2 not ready on going to print.*)

Fourth. To secure accuracy in measurement of time in application and release tests, electrical recording apparatus will be used.

Fifth. Test shall be repeated at least three times under the same general conditions. The temperature at the time of the tests will be recorded.

Rack Tests.

First. APPLICATION TEST (*a*).—Brakes must commence to apply on the fiftieth car in three seconds, or less than three seconds from the first movement of the engineer's valve handle, and must indicate at least 55 pounds in the cylinder of the fiftieth car in three and one-half (3½) seconds or less, from the first movement of the engineer's valve handle. This test will be made with

(1.) 6-in. piston travel.
(2.) 12 in. piston travel.
(3.) 4 in. piston travel.

NOTE.—The object of this time limit is to secure in actual service a minimum length of stop and shock and break-in-twos.

Second. APPLICATION TEST (*b*).—Commencing with the fifth car from the engine, the brakes of three successive cars will be cut out, the brakes will then be applied as per test No. 1 The emergency action should pass these three cars and apply on the fiftieth car in the same time as in test No. 1. Tests will be made with piston travel of 6 in., 12 in. and 4 in.

NOTE.—In freight service the most common method of remedying a defective brake is to cut the brake out; hence it is essential that a limited number of brakes can be cut out successively without destroying the emergency feature.

Third. GRADUATING TEST.—Seventy lbs. train-pipe pressure having been secured, the following tests will be made:

(*a*). A reduction of 8 lbs in train-pipe pressure. This should lightly apply the 50 brakes.

(*b*). A further reduction of 4 to 6 lbs. This should increase the braking power on all the brakes.

(*c*). A reduction to 30 lbs should equalize the pressure between the auxiliary reservoirs and brake cylinders. The piston travel in this test will be 6 in.

Fourth. TEST TO DETERMINE THE SENSITIVENESS OF THE EMERGENCY VALVE.—Three valves selected at random will be taken for this test and each tried separately. The engine and tender brake should be connected in.

A train pipe pressure of 70 lbs. having been secured, the air will be discharged as rapidly as it may through an opening in the engineer's valve of $\frac{7}{32}$ in. diameter. Under this condition, the emergency action must not take place.

NOTE.—The object of this test is to check the introduction of triples which will cause an emergency application when not wanted.

Fifth. Test to determine the holding power of the brake in service application and emergency application.

(*a*) SERVICE APPLICATION.—Gauges will be placed on the cylinder and auxiliary reservoir of the first, twenty fifth and fiftieth car with 70 lbs. train pipe pressure; brakes will be applied by admitting, as nearly as may be, 15 lbs. into the cylinder of the first car. Record of pressure in the auxiliary reservoirs and cylinders will then be taken as follows:

(1) At the first application.
(2) In five minutes from first application.
(3) In ten minutes from first application.
(5) In fifteen minutes from first application.

(*b*) EMERGENCY APPLICATION.—This will be the same as above, except that all the air will be exhausted from the train pipe.

Sixth. Release Test.—The following conditions should be observed in this test:

(*a*) Boiler pressure, 160 lbs.
(*b*) Main reservoir cut out.
(*c*) Pumps 8-in. steam cylinder, 7½-in. air cylinder.

A uniform pressure of 70 lbs. having been secured in the train pipe, all the air will be exhausted by an emergency application. A pressure of 90 lbs. will then be maintained against a diaphragm perforated by a $\frac{7}{32}$ hole, and a record taken of all brakes that release inside thirty minutes. In making this test special care must be taken to see that there is no leak in the train pipe.

NOTE.—This test, in addition to testing the release feature of the triples, is intended as an equivalent to a break-in-two in train service.

Seventh. TEST TO DETERMINE THE TIME OF CHARGING ONE AUXILIARY RESERVOIR.

(*a*) Cut out the brake to be tested by the cut-out cock.

(*b*) Bleed the auxiliary reservoir, empty and close the bleed cock.

(*c*) Secure 90 lbs. pressure on main air reservoir and train pipe.

(*d*) Shut off the pump.

(*e*) Cut in the brake to be tested, and note from the reading of the gauge the time occupied in charging to 70 lbs. The time should not exceed 60 secs., nor less than 45 secs.

NOTE.—The object of this test is to prevent irregular charging of auxiliary reservoirs, and thus insure that the front brakes will not apply after charging.

Train Tests.

In order to provide against defects which a rack test may not develop, it is recommended that railroads make a 50 car train test in actual service before accepting the result from the rack test as final.

Second. In making application test Nos. 1 and 2 with a train, the measurement of time from the first car to the fiftieth car should also be provided for. This will determine the time occupied by the engine brake as against the car brake.

Third. Special care should be taken with the engine and tank brakes in order that they do their share of the braking during the stops, and not pull away from the train.

Fourth. All brake shoes must have a proper bearing on wheels, which is best accomplished by giving them some previous service before testing.

Fifth. Tests to determine the shock should be made on a level track with all the slack in the train pulled out at the time the brakes are applied.

In submitting the above, your committee does not recommend that the Association take final action on the report at the present time. What is presented is intended more as an outline to be improved upon during the coming year.

In following out these investigations your committee has met with much encouragement from members of the committee on Safety Appliances of the American Railway Association and has been in conference with its members about facilities for conducting tests. An essential feature of this work is a permanent location for carrying on the investigations with pipe rack, gauges, recording apparatus, competent assistants, etc. Several of the brake companies have very considerately placed at the disposal of the committee their racks. The committee, however, is glad to announce that the Pennsylvania Railroad Company has offered to establish for the Association, at its Altoona shops, a complete set of brake-testing apparatus and to give every facility for furthering these investigations. This secures for your Association everything that any organization would desire, and when fully established will, without doubt, confer lasting benefits on the railroads of this country.

GODFREY W. RHODES, EDWARD B. WALL, GEORGE GIBBS, *Committee.*

This report was received with applause and Mr. Rhodes was requested to present further argument, which he did as follows:

During the past winter, in appearing before a committee representing the State Commissioners, there was one curious condition of things existing. The representatives of the railroads were advocating the use of certain safety appliances. The Commissioners wanted to require the use of those same appliances, and yet the Commissioners and the railroad companies could not agree, simply because the Commissioners wanted to make it obligatory and the railroad representatives did not feel authorized to say that they should be used yet although they said they were using the devices. Now, one could see that the Commissioners could not reconcile the conditions, where the railroads were advocating the use of certain devices, and yet when the Commissioners say, "We are going to propose that everybody shall use them," the railroads say, "No, we do not want them." I think that the reason for the apparent paradox really was that the Commissioners did not appreciate the crude stage in which these safety appliances still are. In the matter of the coupler, while we feel that we are on the proper track and have got the right coupler, we do not yet feel that it is perfect. The same is true of other safety appliances, and it applies, I think, to the air brake. The committee has said that, "While what has been outlined is a departure from the usual course pursued by railroads, we believe it is warranted under the national and state legislation now going on; for such action will certainly have a tendency to foster and encourage spurious and useless devices."

Now I propose to show some of the difficulties that exist now among the brakes that are on our cars. In the first place we will take the results obtained from five triples of different construction taken off cars passing over our line. I have not thought it wise to give the names of the triples, and so I have lettered them.

TABLE NO. 1.

Triple.	Time in seconds
A	17
B	36
C	42
D	64
E	66

The reason for that is, that the investigation is crude. These tests are made with only one triple of each manufacturer, and cannot be said to represent an average.

Our committee have recommended that the charging time of auxiliary reservoirs, under certain conditions, be not less than 45 seconds and not greater than 60 seconds. The condition under which this test was made was not precisely the same as a test which the committee made some time previously. On the left I have lettered the five triples. On the right I have shown in seconds the time which it took to charge the auxiliary reservoirs to 60 lbs. The condition of the test was this: The main reservoir on train pipe pressure being 90 lbs., the pump being shut off. The length of the pipe was 9 ft. The main reservoir was 19 in. in diameter by 42 in. long. The time is given for these conditions. The D and E triples are about correct; the others are wrong.

The effect of having the A, B and C triple at the front of the train intermixed with other triple would be the charging of front reservoirs first, and when the brakes equalized in the rear reservoirs, on account of the higher pressure in the front reservoirs, the brakes would go on again. This is a simple test which any one can make, and is a test which manufacturers of triples ought to be very careful about.

With the same triples we attempted to compare the service action and emergency action the results are given in tables 2 and 3, marked "Service" and "Emergency" respectively.

TABLE 2.

Service.

Dia. of opening.			Triples.
1	1/64	Service application commences	C, E and D
9	9/64	" " "	B
25	25/64	" " "	A

RANGE.

1/64	A
9/64	C
25/64	E
64/64	D

Emergency.
(3)

Dia. of Opening			Triples.
36	36/64	Emergency application commences	C
49	49/64	" " "	A
64	64/64	" " "	E
81	81/64	" " "	D

(5)

		Triples.
12	Full emergency at once	A
25	" " "	E
42	" " "	D
64	" " "	C

Range.
(6)

1/64	A, E, D
64/64	C

I will refer first of all to the service test. The same length of piping was used as in the other case. We took brass discs (a number of them, some 17 to 20), and in the centre of the disc were openings, starting at a 64th diameter, and increasing by 64ths. The discs were put at the connection with the engineer's valve, and, having secured 70 lbs. in the auxiliary reservoir, all the air was allowed to escape from the train pipe as rapidly as it might through the opening. We found that triples *C*, *E* and *D* began to apply with the $\frac{1}{64}$th opening. Triple *B* did not apply until we put a $\frac{9}{64}$th opening.

Now, when I speak about this opening I want to be understood as referring to the diameter expressed in 64ths. Triple *A* did not go on until the diameter was $\frac{25}{64}$ths.

At the left of the 64ths you will observe the figures 1-9-25. Those show the ratio of the areas to each other.

We desired to determine when the quick action began to appear, so as to get the range of the service feature of the brake. Of course, the wider that range was the less difficulty there would be from the quick action going on when not wanted. In determining when the quick action began to appear the dial of the gauge was watched, and when the arm would move and kick on at the last part of the stroke we considered then we had reached the quick-action feature of the brake.

The first one to show the quick-action feature was *C*, at $\frac{1}{64}$ths, diameter measure. The next was *A*, at $\frac{9}{64}$ths. The next was *E*, at $\frac{25}{64}$ths, and last was *D*, at $\frac{64}{64}$ths.

Now, by deducting one from the other we get the range of the service feature of the brake, given in Table (2).

The one with the lowest range is *A*, with $\frac{9}{64}$ths. The next is *C*, with $\frac{25}{64}$ths, the next *E*, with $\frac{64}{64}$ths, and *D*, with $\frac{64}{64}$ths. The last named is, of course, the safest triple to use. Triple "*A*" has but very little service feature at all. It is nearly all quick action.

In determining the range of the quick action, or the range of the emergency feature of the brake, we got quite interesting results. Table (3) shows the diameters of the openings that will cause quick action at once when the valve is opened. *A* gets very quick action with a diameter measuring $\frac{12}{64}$ths, *E* with a diameter measuring $\frac{25}{64}$ths, *D* with a diameter measuring $\frac{42}{64}$ths, and *C* with a diameter measuring $\frac{64}{64}$ths.

Now the range is obtained in the same way as before. We find that A, E and D have a range of $\frac{30}{64}$ths, that is to say, practically alike. And A, which showed very little service feature, shows a good quick-action feature. The conclusion is that A is almost entirely a quick-action brake; that there is no service feature about it. I can speak of that confidently, because that is the condition of that brake. It is not a joint service and quick-action. It is almost a quick-action by itself, and disastrous results would follow if placed with others in a train. If one of those brakes went on partially slow action and then followed with the quick action, as it would be sure to do, it would bring about bad results.

But, perhaps, the most interesting case is that of C. We find that in place of C getting its quick action with a short range it does not get it until the diameter is increased $\frac{64}{64}$ths; in other words, it is not strictly speaking a quick-action brake. It is just the reverse of "A;" that we can also speak of confidentially, not only on the one test, but it has is proven to be so in service.

A triple such as "C" is will be a very tardy quick-action brake, and in certain lengths of train the quick-action feature would die out entirely. Even in a 50 car train the quick-action feature would die out entirely.

These experiments show a way by which the sensitiveness of the service feature of triples and the sensitiveness of the emergency feature of triples may be measured and gauged pretty accurately. The committee think by following this line of investigation that we will be able to determine a measure for graduating brakes. When that is accomplished, in place of having all the experimenting going on in the cars that are passing over these roads, they can be made in the shops and not put out in service until the brake is perfected.

Now, I want to refer again to what I said at the commencement. Our State Commissioners and our legislators do not realize these things. They say: "It is good enough—use it." The reason that railroad people hesitate with these same matters and do not wish to have obligatory legislation is because they know that they are not perfect, and until we get some means of determining accurately that what we have got is good there is going to be more trouble than good obtained by forced legislation. (Applause.)

The committee appointed to report on subjects for the coming year recommended that the Executive Committee be requested to select the subjects and appoint the committees.

The Committee on Resolutions presented the following, which was adopted with applause:

WHEREAS, The members of the Master Car Builders' Association have, during the period of this convention, enjoyed special courtesies and privileges, and desire to make public acknowledgment of the same:

THEREFORE, Your committee submits for adoption by the Association, in this convention assembled, the following resolutions:

Resolved, That the thanks of the Association be tendered to the several parties who have so kindly contributed to the success of the convention and to the pleasure of the members, as follows:

To the citizens of Saratoga for their hospitable reception and welcome, as exhibited to the Association by the President of the village.

To the Delaware & Hudson, Fitchburg, New York Central Railroad companies for the courtesies of transportation and excursions as tendered by their representatives, and to the *Railway Age and Northwestern Railroader* for the daily publication of convention news and proceedings.

The Association this year is especially indebted to the officers of the D. & H. C. Co. for the able manner in which they have conducted the excursions and transportation arrangements.

The following places were suggested for meeting next year: Saratoga, New York City, Old Point Comfort, Milwaukee and Put-In-Bay.

The convention closed with speeches by the new President, Mr. E. W. Grieves, First Vice-President F. D. Casanave, Third Vice-President T. A. Bissell, and Pulaski Leeds, a new member of the Executive Committee.

On Saturday the Association in a body, together with the friends of the members, enjoyed an excursion to Lake George tendered by the Delaware & Hudson Canal Co.

There was a large attendance at this convention, and

satisfaction is expressed by those present about the arrangements for the work and entertainment of the Association.

EXHIBITS.

Am. Ry. Equipment Co., New York. Model of Vestibule and step for passenger cars and outward opening window.

American Washer & Manufacturing Co., Newark, N. J., samples of nut locks and ratchet washers.

American Steel Wheel Co., New York City, sections of steel wheels. Section of wheel that has run 122,880 miles.

American Coupler Co., Syracuse, N. Y., vertical plane M. C. B. car coupler.

A. French Spring Co., Pittsburgh, Pa., oil box lid, dummy couplings, and locomotive spring with V band.

American Car Door Co., Indianapolis, Ind., American flush car door.

Allison Manufacturing Co., Philadelphia, Pa., model of dump car.

American Machinery Co., Detroit, Mich., a novel universal trimmer for pattern makers' use.

B. F. Baker, Balston Lake, N. Y., expanding spring bucket for pumps.

R. E. Tilden & Co., Chicago, Ill., car replacer.

Boyer Railway Speed Recorder Co., St. Louis, Mo., Boyer speed recorder.

B. F. Sturtevant Co., illustrations of shop heating and ventilating.

Bowers Manufacturing Co., Newark, N. J., three-ply embossed decorated veneer ceilings.

Blakeslee Manufacturing Co., Cleveland, O., samples of small forgings and photographs of forging machines.

Jos. Blattner, Allegheny, Pa., model metallic coupling for air and steam.

Bradley & Co., Syracuse, N. Y., samples of cushioned hammer.

Butler Drawbar Attachment Co., Cleveland, O., Butler drawbar attachment, full size, attached to wooden sills.

F. W. Bird & Son, East Walpole, Mass., water-proof fabrics for car roofing, model of car roof.

E. L. Bushnell Spring Co., Poughkeepsie, N. Y., car seats.

Buckeye Automatic Car Coupler Co., Columbus, O., vertical plane car couplers and samples of high grade malleable iron.

Burrowes Car Shade Co., Portland, Me., car window shades.

Chapman Jack Co., Cleveland, O., jack screws that have been tested in service.

R. G. Chase, Elsdon, Ill., Mullen roller side bearings.

Car Ventilator Co., Philadelphia, Pa., Pancoast ventilators for passenger cars.

Columbian Metallic Rod Packing Co., Philadelphia, Pa. metallic piston and rod packing.

Congdon Brake Shoe Co., Chicago, Ill., the Columbian vertical plane cast steel coupler and cast steel castings.

Cushioned Car Wheel Co., Indianapolis, Ind., cushioned car wheels from service 115,000 miles with $\frac{1}{32}$ in. wear.

Consolidated Car Heating Co., Albany, N. Y. This company has a large and interesting exhibit of working models of the multiple, hot water circulation, coil drum, disc drum, commingler storage cell and standard commingler steam heating systems, also samples of the standard McElroy and Sewall steam hose couplers.

Coolbaugh & Pomeroy, New York City, Luken's machine flanged steel boiler heads with Luken's improved manhole, the new plate and double corrugated spoke Boies' steel car and locomotive truck wheel and Cambria steel axles and crank pins.

Coburn Trolley Track Manufacturing Co., Holyoke, Mass., model of a car door.

J. L. Cory, Green Island, N. Y., model of Trojan oiler.

Chicago Grain Door Co., Chicago, Ill., model of grain door.

Crosby Steam Gauge and Valve Co., Boston, Mass., muffled and plain pop safety valves, phosphor tin, locomotive counter, steam gauges, engine indicators, of a new design, chime whistles, oilers and Johnstone blow-off cock. A large locomotive chime whistle attached to boiler in yard sounding 3 times daily.

R. A. Cowell, Cleveland, O., a model of vertical plane car coupler.

Damascus Bronze Co., Pittburgh, Pa., samples of car and crank pin brasses.

Henry Deitz, Chicago, Ill., link and pin, M. C. B. and Miller couplers with reversible head.

J. C. Devlin, Memphis, Tenn., vertical hook car coupler.

Detroit Lubricator Co., Detroit, Mich., triple lubricator and Garfield injector.

Dreher Mfg. Co., New York, samples of Cooling Compound.

Drexel Railway Supply Co., Chicago, Ill., cast steel vertical plane car coupler, oil box lid and freight car door.

Ewald Iron Co., St. Louis, Mo., samples Tennessee bloom firebox and flange iron, special forgings.

Ensign Manufacturing Co., Huntington, W. Va., models of the Russell snow plow.

Empire Car Coupler Co., New York, full size model vertical plane car coupler.

Erie Car Heating Co., Erie, Pa., samples of car heating apparatus.

Fox Solid Pressed Steel Co., two pressed steel trucks and two cars with pressed steel truck at depot.

Geo. L. Fowler, New York, model of locomotive ash pan for anthracite fireboxes.

Geo. A. Furguson, Greenville, Tex., automatic air brake pipe coupler in operation, vertical plane coupler, metal tie and rail fastening.

Fairbanks Co., Boston, Mass., valves and steam specialties.

Falls Hollow Staybolt Co., Cuyahoga Falls, O., hollow staybolts and staybolt iron, samples of muckbar.

Gilmour Manufacturing Co., New York, asbestos pipe covering, jacketing and non-conductors of heat for various purposes.

Graves Car Coupler Co., Cedar Rapids, Ia., a model of couplers for street cars.

Greene, Tweed & Co., New York, pipe wrenches and ratchet drills.

Geometric Drill Co., Boston, Mass., Geometric drill in operation.

Gold Car Heating Co., New York, car heating apparatus, storage cylinder, couplings, steam traps, double circulating system, overhead system, and various steam heating novelties.

H. W. Johns Manufacturing Co., New York, asbestos goods and samples of asbestos goods and vulcabeston.

Hale & Kilburn Manufacturing Co., Philadelphia, Pa., photographs of chair and car seats.

Hartford Woven Wire Mattress Co., Hartford, Conn., samples of car seats and mats.

C. B. Hutchins & Sons, Detroit, Mich., model of freight car roof.

M. C. Hammett, Troy, N. Y., tornado car ventilators and crank pin gauge.

Hayden & Derby M'f'g Co., New York, metropolitan Injector, ready for service and in section.

Hinson Car Coupler Co., Chicago, Ill., vertical plane car couplers.

Hinckley Brake Co., Trenton, N. J., brake slack adjuster, full-sized working apparatus, with air pump for working brakes.

Hughes Car Heating and Ventilating Co., Toronto, Ont., water color illustrations of heating and ventilating system.

Ide Wrench Co., Troy, N. Y., chain pipe wrenches of various sizes.

C. C. Jerome, Chicago, Ill., samples of metallic packing.

E. M. Judd, Wallingford, Conn., vertical plane car coupler.

Jewett Supply Co., Boston, Mass., roller centre and side bearings for cars.

Jenkins Brothers, New York, samples of valves, discs, packing and regulators.

Robert B. Johnston & Co., car and locomotive concave springs.

Keegan & Halpin, New York, Wells light alone and as applied to a tire setting machine.

Knitted Mattress Co., Canton, Mass., knitted mattress goods for car seats and bedding.

Lochner & Randall, Adrian, Mich., model of automatic buffer car brake.

Horace N. Loomis, Hightstown, N. J., metallic weather strips.

H. L. Leach, Boston, Mass., sand-feeding apparatus for locomotives attached to air pump and in working order; also full size instruction model.

Marden Car Brake Co., Boston, Mass., sample of steel brake beam.

Meneely Bearing Co., West Troy, N. Y., samples of tubular roller bearings; various sizes.

Massachusetts Mohair Plush Co., Boston, Mass., samples of mohair plush for car seats.

Morris Box Lid Co., Pittsburgh, Pa., pressed steel oil box lid.

Mason Regulator Co., Boston, Mass., steam regulating devices for locomotives and steam heating systems.

McGuire Mfg. Co., Chicago, Ill. Photographs of street railway cars and trucks.

Morton Safety Heating Co., Baltimore, Md., model of car heating apparatus.

Moran Flexible Steam Joint Co., Louisville, Ky., flexible metallic steam joints for large water pipes and for steam heating connection.

A. O. Norton, Boston, Mass., roller bearing jack screws.

National Car Door Co., Decatur, Ill., the Decatur car door.

Nathan Manufacturing Co., New York, lubricators and injectors.

National Supply Co., Baltimore, Md., model of car replacer.

New York Car Wheel Works, Buffalo, N. Y., samples of ground and balanced car wheels.

National Malleable Castings Co., Cleveland, O., car door fastener, malleable iron centre plate of new design.

National Lock Washer Co., Newark, N. J., samples of nut locks.

Northwestern Equipment Co., Chicago, Ill., Kewanee rectangular brakebeam and gauge for worn coupler knuckles.

National Hollow Brakebeam Co., Chicago, Ill., hollow brakebeams of several sizes.

Oliver Iron and Steel Co., Pittsburgh, Pa., samples of iron and steel forgings.

Oakes Manufacturing Co., Chicago, Ill., rotating hook car coupler.

Pantasote Leather Co., New York, samples of Pantasote leather for decorations, ceilings and window shades.

Putnam & Stiles, New York, sample of adjustable car step.

Palmer Car Ventilator Co., Boston, Mass., models of car ventilator for passenger cars.

Arthur Penwell, Kansas City, Mo., water purifier and cleanser.

Pero Car Coupling Co., New York, model of vertical plane coupler.

Philip Carey Manufacturing Co., Cincinnati, O., model of freight car roof.

Positive Lock Washer Co., Newark, N. J., samples of nut locks.

Pratt & Letchworth, Buffalo, N. Y., Pooley vertical plane automatic coupler.

Peerless Rubber Manufacturing Co., New York, samples of rainbow packing, rubber goods, universal gasket and tubing.

Perfected Coupler Co., Chicago, Ill., vertical plane car coupler, draft gear and interchangeable Miller and Janney passenger coupler.

G. V. Putnam, Gloversville, N. Y., model of cut off for stationary and locomotive engines.

R. Bliss Manufacturing Co., Pawtucket, R. I., Woods passenger car platform gate.

Ross Valve Co., Troy, N. Y., reducing and gate valves.

Self Winding Clock Co., New York, self-winding synchronized clock; as used at U. S. Observatory.

H. E. Spaulding, Saratoga, N. Y., self loading hand truck.

Safety Car Heating and Lighting Co., New York City. This company has an exhibit of the Pintsch car lighting outfit in the hotel office showing the greater illuminating power of the Pintsch gas when compressed as compared to the city gas when uncompressed. When compressed, city gas loses about 40 per cent. illuminating power. The exhibit shows both gases burned at the same pressure at the burner, and at the same rate of consumption, and under these equal conditions the Pintsch has about six times the greater illuminating power.

Scarritt Furniture Co., St. Louis, Mo., photographs of chairs and car seats.

Schenectady Locomotive Works, Schenectady, N. Y., three compound locomotives; one 10-wheeler, 141,000 lbs.; one 12-wheeler, weighing 138,000 lbs.; one mogul, weighing 132,500 lbs.

Standard Steel Works, Philadelphia. Samples of wrought car wheels in various stages of manufacture, from blanks to completed wheels ready for the tire. Also an interesting half section of completed wheel etched to show perfection of welds.

Shoemaker Automatic Car Coupler Co., Philadelphia, Pa., automatic car coupler.

Smillie Coupler and Manufacturing Co., Newark, N. J., vertical plane car coupler.

Spirittine Chemical Co., Wilmington, N. C., samples of spirittine, oil and wood fillers.

Safford Automatic Coupler Co., Boston, Mass., link and pin car coupler.

Simonds Rolling Machine Co., Fitchburg, Mass., samples of rolled pins, balls and rolled steel specialties.

Standard Car Coupling Co., of New York, vertical plane car couplers and a drop testing plant with hoisting engine all built according to the proposed plan for standard M. C. B. tests of vertical plane couplers.

Schoen Manufacturing Co., Pittsburgh, Pa., samples of pressed steel centre plates, stake pockets, draft rigging, brake beams and an excellent pressed steel journal box.

Thornton N. Motley & Co., New York, malleable iron torches for engineers and firemen.

The Elastic Packing Mfg. Co., Newark, N. J., samples of elastic waste for packing journal boxes.

Topping & Fox, New York, Wheelers metallic packing for piston rods, valve stems, etc.

Turner Storage Receptacle Co., Chicago, Ill., card receptacle for freight car orders.

Thurmond Car Coupling Co., New York City, vertical plane car coupler for passenger and freight cars, swivel M. C. B. coupler head for locomotive tenders, carrier iron allowing lateral play on curves and passenger car platform and buffer.

Trojan Coupler Co., Troy, N. Y., vertical plane car coupler.

United States Metallic Packing Co., Philadelphia, Pa., metallic piston rod packing.

Universal Brake Beam Co., Chicago, Ill., galvanized brakebeam of U-shaped section.

Vose & Cliff Spring Co., New York, illustration and model of a new locomotive spring and model of King flexible side bearings.

Vacuum Oil Co., Rochester, N. Y., vacuum cooling compound for hot journals.

Vulcan Car Coupler Co., Cleveland, O., vertical plane car coupler.

Van Dorston Cushioned Carrier Iron & Railway Supply Co., Washington, D. C., model of cushioned carrier irons for drawbars.

Vitrified Wheel Co., Westfield, Mass., sample of corundum and emery wheels.

Williams' Automatic Car Coupler Co., Chicago, Ill., vertical plane car coupler.

W. Haskell King Co., New Haven, Conn., noiseless sash support.

Weeks, Bush & Co., Roudout, N. Y., automatic knuckle opener for M. C. B. coupler.

White Car Lubricator Co., Concord, N. H., samples of the White dust guard.

H. A. Wheeler, Chicago, Ill., Edward's car window.

Watson Car Coupler Co., Paterson, N. J., vertical plane M. C. B. car coupler.

William Yerdon, Fort Plain, N. Y., hose band for air and steam hose.

Harrison's Journal Lubricator and Sectional Dust Guard.

A new journal lubricator and a sectional dust guard are shown by figs. 1, 2 and 3, herewith. The lubricator consists of a cradle supported by four coiled springs and a base plate, with adjustable slides to fit the bottom of the journal box, as shown in figs. 1 and 2 The cradle is made in three parts, all perforated. The perforated bottom plate has, at the corners, four arms, the extensions of which rest upon the springs. These arms also act as guides for the perforated side plates. The base plate carries four pins or uprights for the coiled springs, also the adjusting clamps, to prevent lateral or end motion. This device can be placed in any journal

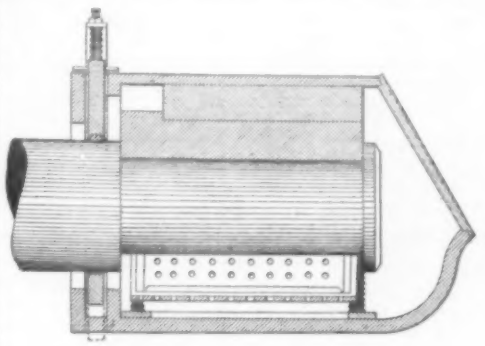


Fig. 1—Lubricator and Dust Guard.

box. The waste is placed in the cradle surrounding the lower part of the journal, and the springs press it evenly against the journal. Oil is poured into the box in the usual manner.

The sectional dust guard, fig. 3, is made in two parts

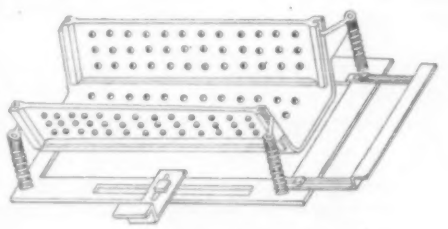


Fig. 2—Lubricating Cradle.

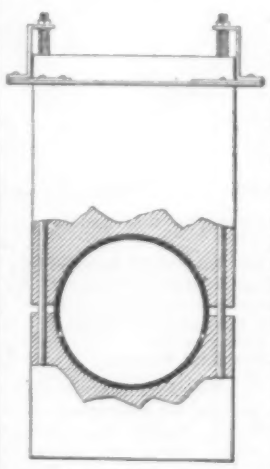


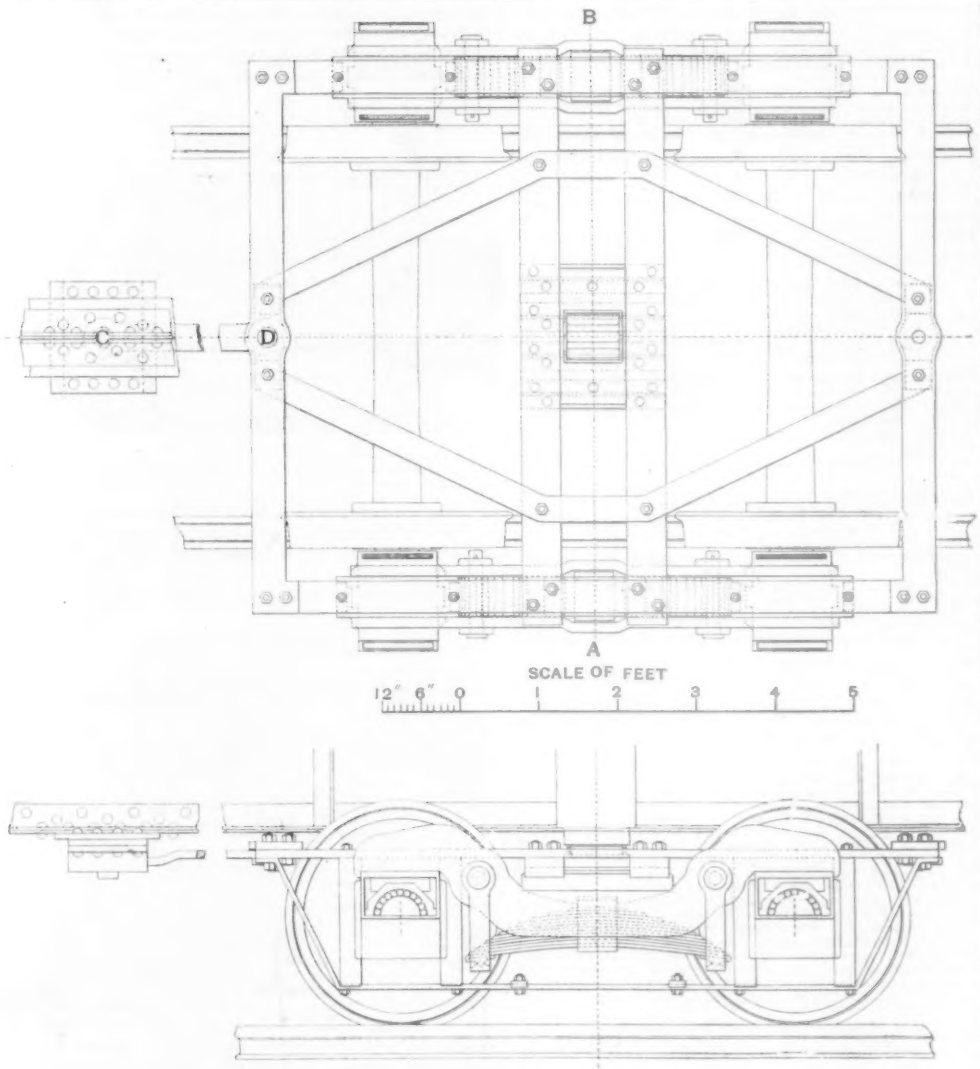
Fig. 3—Dust Guard.

connected by two rods running through them vertically, the upper half being free to move upon the rods. The upper ends of the rods are threaded and extend beyond the upper section far enough to take a nut above the supporting wrought iron frame, as shown. Between the frame and the upper section are two coiled springs surrounding the rods. The opening in the dust guard for the journal is rabbeted out to receive a packing ring. The ring is circular and is divided into two parts, one being larger than the other, to break the joints. The lower half of the guard is held against the journal by adjusting the nuts on the rods and the upper half is pressed down by the coiled springs. The lubricator and dust guard are the invention of Mr. F. B. Harrison, Toledo, O.

Test Loads for Bridges.

Relative to the subject of test loads for bridges, to which, as noted in a recent issue of the *Railroad Gazette*, attention was directed a short time ago in a German contemporary, the *Centralblatt der Bauverwaltung*, the value of such test loads being there much disputed, a correspondent of that journal now comes to their defense. Test loads for bridges, he says, must not be expected to show things outside of their province, and their purpose is not to determine whether or no a certain bridge is absolutely safe, but to give warning of increasing weaknesses by repeated applications.

Ordinary bridge inspection, despite all reasonable care, often fails to show up serious defects in a structure, owing not only to natural shortcomings of the inspector, but also to the circumstance that some of the parts of a bridge, at the abutments for example, are not easily accessible and hence escape careful examination. If, however, the deflection of a bridge under an actual test load be compared with the theoretical calculated deflection, we have the means of knowing whether some serious defect has been passed unobserved. In such a case, then, the test loading would have served an eminently useful purpose, and such cases are maintained to abound, a number of examples being given. If a series of test loads have been applied to a bridge at intervals and the deflections are found to be on the increase, then, even though inspection should fail to reveal any structural defect, the conclusion is unavoidable that the sustaining capacity of the bridge is growing less and proper measures for strengthening or rebuild-



TRUCK FOR TRANSPORT CAR—DALLES BOAT RAILROAD.

ing may be taken without waiting for some accident to serve as a serious warning.

Rather than to abolish test loading, as proposed by some, the correspondent of our German contemporary is of the opinion that the practice should be extended so as apply to even the smallest iron and steel bridges.

The Proposed Dalles Boat Railroad.

In 1888 a report was made by a board of engineer officers upon the best means of passing the obstructions in the Columbia River at the Dalles. Several plans were presented, but the one which the Board adopted and recommended is for a boat railroad. This plan calls for a railroad 45,100 ft. long from Big Eddy to a point above Celilo Falls. It is proposed to transfer boats from the water to the railroad and back again by hydraulic lifts, and the car is designed to transport vessels 165 ft. long and 38 ft. beam. The boats to be transported are estimated to weigh with their cargoes 600 tons, the weight of the cradle is estimated at 184 tons and of the car at 300 tons. The maximum lift at low water is 68.2 ft. It is proposed to lay a railroad of two standard gauge tracks 20 ft. between centres with 90 lb. rails. It is considered that an alignment consisting of straight lines connected by turntables is impracticable, owing to the regular character of the ground, and therefore the plan involves two-degree curves. A turn-out 1,700 ft. long is recommended about midway. This also will be entered by two-degree curves. The maximum gradients are 0.6 per cent.

The car for transporting the boats was designed by Lieutenant Burr, Corps of Engineers, U. S. A., one of the Board. It is composed of a plate girdar platform carried on four-wheel trucks. The platform is 168 ft. long by 38 ft. wide. The trucks are 34 in number, that is, 17 on each track. They are 20 ft. apart, centre to centre, laterally, and 10 ft., centre to centre, longitudinally. The wheels of each truck are 5 ft. between centres, giving 5 ft. intervals between all wheels on one rail. The fourth truck from each end has a kingbolt connecting it with the platform above. Thus there are two trucks 100 ft. apart to guide the car. The remaining trucks move laterally to accommodate themselves to the alignment of the track. They pivot by radius bars around points 8½ ft. from their centres, and the trucks are provided with sets of rollers on which the platform shifts. One of these trucks is shown in the engravings herewith. This project is now before Congress for an appropriation in the River and Harbor bill. Its total cost is estimated at $3,576,356, including all necessary buildings and rolling stock.

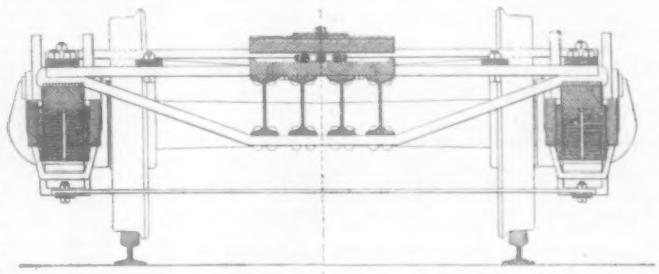
Our special purpose in calling attention to this matter is to lay before the reader the following communication on the subject addressed by Mr. John F. O'Rourke to the Chairman of the River and Harbor Committee of the House of Representatives. Mr. O'Rourke needs no introduction to our readers; his communication follows:

In view of the fact that your Committee have under consideration the advisability of making an appropriation for the construction of a boat railway along The Dalles of the Columbia River, I take the liberty of suggesting a few reasons against the government's spending any more money on this project at present. First, I should say that I am strongly in favor of ship or boat railways in all cases where they are practicable, as probably affording, in the present state of engineering science, means of navigation across obstructions between natural waterways that are more expeditious and economical to build and operate than canals. But I think that their most enthusiastic advocate will hardly recommend them as the proper thing along the rugged windings of a rough side hill river bank. I have been interested for a number of years in ship railways, and for the past three years have been the engineer of Messrs. Dawson, Symmes & Ussher, contractors for the Chignecto Ship Railway, so that I may claim a fair degree of familiarity with the subject.

The idea of ship railways is not new, but the first one to be finished and operated remains for the future. The Chignecto Ship Railway is the first on which any construction has been attempted, and is, perhaps, the only one of which every minute detail has been studied and developed, until no uncertainty remains of its entire practicability. Some of the most eminent engineers in the world were engaged on this task and when they had eliminated each successive difficulty there were no curves left in the line, which is an unbroken tangent from end to end; the maximum grade was $\frac{3}{10}$ per cent., or $\frac{1}{33}$ that of the boat railway that you are considering, and the lifting docks were designed to be operated by hydraulic presses having a stroke equal to the whole height to be lifted, while traverse tables were adopted as the means of permitting vessels in transit to pass by each other. Thus absolute simplicity was finally reached, and then, and not before then, could the Dominion Government and private capital be enlisted in its behalf.

It is considered that this ship railway will be ready for operation by the fall of next year, and the lessons which it will teach, after navigation on rails becomes an every day fact, may point a way not yet known to the successful adoption of a curved alignment, turnouts, and steeper grades, and it is surely not more than common prudence to await the results of that experiment before undertaking another that is many times more difficult, and that too at a situation that is totally unsuited for such a purpose.

The governing idea of the Columbia boat railway is that a car 168 ft. long, 38 ft. wide and borne on 34 trucks, weighing in all 300 tons, can carry a loaded vessel 165 ft. long, 38 ft. wide and weighing 600 tons. The total weight, therefore, that is distributed over 160 ft. of double track is 900 tons or $2\frac{5}{8}$ tons per foot of single track, being more than twice the weight possible to concentrate by any known trains either of locomotives or cars. It is assumed that this long and heavy car can pass around two degrees curves and be shunted on sidings at passing points such as an ordinary train would be.



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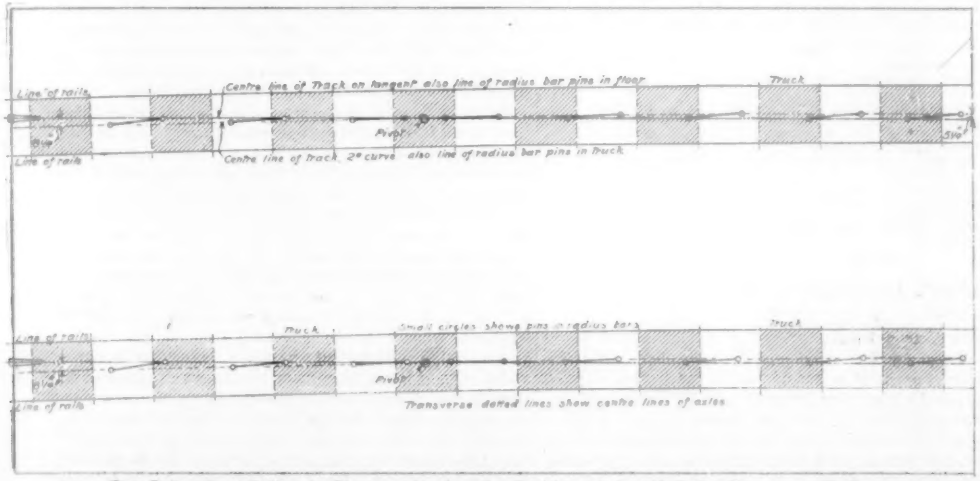


The Dalles Boat Railroad—Diagram showing the Position of One-Half the Car in a 2° Curve.

There is nothing whatever in present railway practice to warrant any such assumption. In the first place it is doubtful if a track which is no stronger than one of the standard type is equal to the task of bearing in ordinary use without great risk of disaster a load which is more than twice as great as any standard track has yet borne even on the most extraordinary occasions, which is what this plan proposes. However, an examination of the novel and ingenious car given in the report shows that it is still not a question of track, but of car. I have prepared a sketch showing the position of the wheels on a two degree curve, by which you can see that when the trucks swing 8¼ in. or less (not 5¼ in. as given in the report) on about a 4½ ft. radius from the line of the radius bar centres that all the trucks but the four pivoted ones sit on the tracks in different positions grinding against one or another rail at varying angles, being pulled out of line by the obliquity of the radius bars and tending to occupy a wider space than the gauge with diagonally opposite wheels. This tendency is proportional to the amount of deflection. In the pivoted trucks the pull of the locomotive being also oblique there is great side friction with them as well. It is quite safe to say that if you took a common train and attached to ½ of all its trucks eccentric bars acting with similar obliquity its locomotive could not again start it, for they would tend to swing around in the line of the force and simply bind against the rails.

Another point fatal to the practicability of this car is that the weights on each pair of trucks as they deflect upon entering a curve become unequal, depressing the nearer springs correspondingly while the farther ones rise an equal amount, and the centre of gravity sinks, being no longer midway between the tracks. An additional resistance other than friction is thus introduced which must be overcome in getting the

trucks back to place on the next tangent, that is to say, that the load when unequally distributed will compress the springs more than if each bears an equal share and through this, the height of the difference, the load on those trucks will have to be lifted when the bearings are restored to the centre. In other words, the rollers will have to move up inclined planes, though they are evidently designed for the level, and this is added to by the deflections of the cross-girders under the load, so that instead of having to deal with friction only in determining the force necessary to operate the swinging trucks a part of the weight must also be taken into consideration as having inevitably to be lifted. If the trucks were all exactly in line with the rails, instead of nearly all tending to turn askew in the serious manner pointed out, it is not likely that two engines like those proposed could move it on or off the two-degree curve we are considering. Finally, remembering that the side of the rails is the fulcrum against which all these forces of obliquity of wheels, lateral reaction of swinging trucks, often wedging up the whole load on them, and with an array of grinding flanges such as no other combination of wheels ever before presented, we are confronted by a braking power that it is simply out of the question to overcome by traction. This would be true of any other way that might be devised for moving the trucks sideways by the reaction of the sides of the rails, so no plan can possibly be feasible which does not provide a force for this purpose acting against the body of the car, that is to say, by means of a power located on the car.

It is stated in the report that turn tables connecting stretches of tangent were inadmissible. This car that is designed to run on curves, but so plainly cannot, is the best thing of its kind yet proposed by any engineer. Therefore, it follows that the proposed Boat Railway, although so well designed in nearly all individual matters taken by themselves, is a fore-ordained failure as a means of transporting boats.

There is a physical difficulty opposed to taking large structures around curves that engineers have not yet learned to surmount and it is only in the abstract that the problem of transporting them along straight lines can be considered solved, for with all due respect to the gentlemen with whom I differ, this whole business is experimental even if some of the processes are old, and I again repeat that a more inexpedient place to experiment with a matter at once so complex and immense, as the one here selected would be difficult to find.

It is scarcely necessary to criticise the estimates—I must say, however, that they seem extraordinarily low. The Chignecto Ship Railway, with a roadway 5 ft. narrower than proposed here, and not quite twice the length, has nine times as much masonry, every important structure of which is faced with coursed ashlar, as should be done, and there is five times the amount of excavation, although the line runs across a country so easy to grade that no cutting or embankment exceeds 40 ft., and lies for miles through a region that is almost level.

The maintenance estimate is too low. The item of renewal of rails each year would be ten times what is estimated for everything together, provided the cars could be made to grind their way several times backward and forward daily, and a single wreck amid the perilous navigation of the curves and switches would cost more for removal and damages than a car and its cargo, besides blocking the road for weeks, so that the amount requisite for operating such an extremely difficult system is very likely to run into large figures.

I may add that I keenly regret that the United States has allowed Canada to precede her in introducing this novel and revolutionizing mode of transportation, a feeling I am sure that every member of your committee shares, but let me earnestly beg that when Congress does come forward in aid of some such enterprise you will see to it that it be given a fair trial in some locality that is suitable, and not impose on this latest and most promising offspring of engineering a task for its infancy that may exceed the greatest resources of its mature development.

I also have the honor of inclosing a short paper which was read last year at the annual meeting of the American Society of Civil Engineers in connection with a longer oral description which may give you a better idea of a practicable ship railway and of the character of the work that is necessary to secure its permanence.

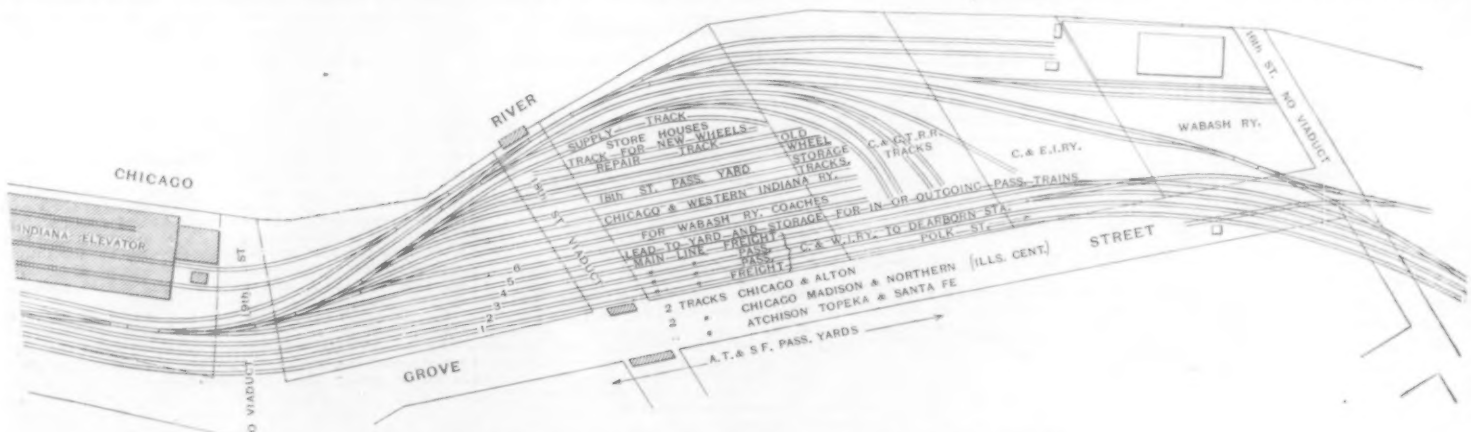
NEW YORK, May 31, 1892.

Switching and Car Cleaning at Dearborn Station, Chicago.

The roads entering Dearborn Station at Chicago have turned over to the Chicago & Western Indiana Railway the care of all passenger trains and cars after arriving at the station. By this arrangement the Chicago & Western Indiana does all the switching and car cleaning as well as all light road repairs, except in one instance. The Atchinson, Topeka & Santa Fe has its own passenger yards at Eighteenth street, and will do its own cleaning and repairing.

In order to handle this business properly and expeditiously, the Chicago & Western Indiana will distribute the work in the following manner. At the Dearborn Station there are two passenger yards, situated on either side of the main tracks. There is a third yard at Eighteenth street, parallel to that owned by the Atchison, Topeka & Santa Fe, but between it and the river. The two yards at Dearborn street will accommodate 120 cars, and the Eighteenth street yards will hold 75 cars. The cars of the Chicago & Eastern Illinois, Chicago & Erie, Chicago & Grand Trunk, and the Louisville, New Albany & Chicago will be cleaned and stored at the Dearborn station yards, and those of the Wabash will be cleaned and stored at the Eighteenth street yard. All renewals of wheels or heavy repairs to trucks are made at the Eighteenth street yards, except for the Chicago & Grand Trunk cars, which is done at Dearborn yards. The work also includes the sleeping cars run on those roads. The wheel repairs, car cleaning, etc., for the Chicago & Grand Trunk at the Dearborn station include like service for any Pullman or Wagner cars used by that road.

All the yards are provided with water and sewer connections, and are piped for supplying cars with Pintsch compressed gas. The Eighteenth street yard, built recently by the Chicago & Western Indiana is so arranged that it may be extended in case the company can secure adjacent property owned by the company but leased and used by other railroads.



CAR SWITCHING AND CLEANING YARD AT DEARBORN STATION, CHICAGO.

In the engraving is shown the arrangement of the Eighteenth street yard, and the main line tracks of the Chicago & Western Indiana, over which run all trains to and from Dearborn Station and all freight trains of the Wabash, the Chicago & Eastern Illinois, the Chicago & Grand Trunk, and the Louisville, New Albany & Chicago. The yard is entered at Nineteenth street from Track No. 5 by means of a ladder track. Track No. 5 is a lead from main line track No. 4, north of Seventeenth street. All trains going to or from this yard arrive or leave by this track, and in case of blockade trains are stored on it temporarily. There are seven wash tracks, one repair track, and one storehouse or supply track. The eight spur tracks terminate at the platform at the north end of the yard. This platform is used for cleaning carpets and cushions. Upon the repair track are placed all cars needing wheel or heavy running repairs. Alongside of this track are a wide platform and a storage track for new wheels. At the end of the spur track beyond the platform are short storage tracks for old wheels, having a capacity for about two carloads. These tracks are assigned to the different roads, and when filled, flat cars are placed opposite them on the wash tracks, and the wheels loaded. This yard being so close to the Chicago River has excellent drainage. There are ample sewer connections provided, but the yards were excavated and filled in with stone, gradually decreasing in size, and finished with a top-dressing of broken ballast. This arrangement insures a reasonably dry yard. At either end of the yard there are placed double cross-overs in the main line tracks to facilitate handling yard trains and making it possible to reach the yard from any main track in either direction.

The basis on which all cleaning and repair work will be charged for according to the new arrangement is, the actual cost of the work done; the wheels and other heavy material for repairs are furnished by the various roads, parties to this arrangement.

Enlargement of the Waterloo Station.

The Engineer of May 20 and 27 contains a brief account of the work that has been done during the past five years in enlarging the Waterloo station of the London & Southwestern in London. The work included the construction of two additional main tracks from the terminus out as far as Nine Elms. The road, for most or all of this distance, is carried on a viaduct, the width of which has been increased from 47 ft. to 78 ft. The openings were formerly covered with cast iron girders, but these have been replaced by wrought iron and steel bridges. One of the most important parts of the work was the rebuilding of Vauxhall station. New signal cabins and new locomotive sheds have also been built. The Waterloo station, which in 1878 had only ten platforms, was enlarged in 1878 and 1885, and now again, until it has 18 platforms, or rather 18 tracks which run alongside of the platforms. Among the other improvements in connection with the enlargment of the train shed is the removal of all the telegraph wires so that none are visible in or around the station. This change was carried out as far as Clapham Junction.

It is claimed that this is the biggest station in the world, and the writer of the article referred to says that the largest day's work ever done was at this station, the next largest having been at the St. Lazare station of the Western of France, in Paris in 1889, on the occasion of the Centenary fêtes at Versailles.

The most interesting feature of the new station is the arrangement of signals and switches, and the task of abolishing the old tracks and signals, and putting new ones into use was, perhaps, the most intricate problem in the whole work. A diagram showing the new arrangement was printed in the *Railroad Gazette* of Oct. 2 last, in connection with a statement of the very heavy day's work done on July 11, 1891, when 859 trains ran in or out of the station. The principal tower, Box A, contains 236 levers. *The Engineer* refers to the fact that the signal tower at the London Bridge station, on the London, Brighton & South Coast, contains 280 levers, and that at the Euston station of the London & Northwestern contains 283, but it is said that at Waterloo many more movements are made with the same number of levers; and that the Waterloo interlocking machine, if arranged on the ordinary plan, would require 400 levers instead of 236.

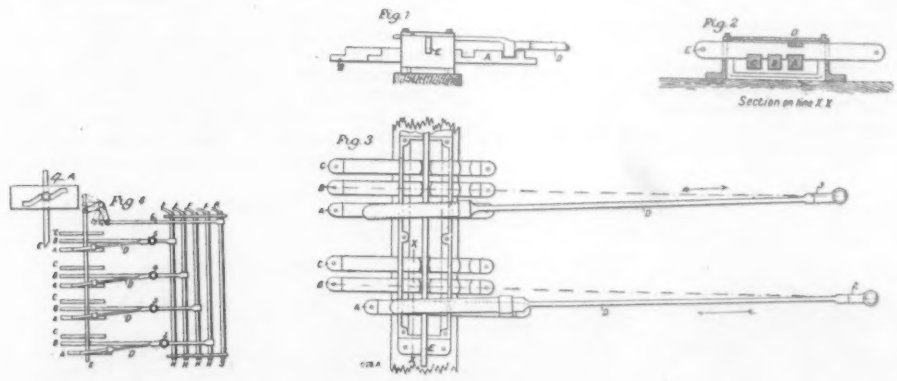
The article in *The Engineer* is largely devoted to a description of the selector and other "Simplex" arrangements invented by Mr. J. P. O'Donnell and applied in a very complete manner at this tower. The selector is shown in the accompanying illustrations. Fig. 3, which is a plan, shows clearly how the tail bar of the signal lever is moved so as to operate either *A*, *B* or *C*, which actuate, respectively, signals *A*, *B* and *C*. The tail bar *D* is moved by *E* in accordance with the position of the switch rails. Fig. 4 shows how a single lever, attached at *R*, is used to throw the four signal levers, 2, 3, 4 and 5, simultaneously in a certain direction, as, for instance, each of them to the right-hand signal of the three signals which the lever is arranged to operate. Fig. 4*a* shows a motion plate which is used instead of the bell crank to connect lever *R* with bar *E* whenever it is practicable to do so.

The object of this last arrangement seems to be to provide for a way of working which we believe is not in use in this country; that is, the provision of two separate signals for precisely the same route, one to be used for regular train movements, and one for switching movements in the same direction. But, considering the fact that some American roads, as well as roads in England, find it hard to abolish hand signaling in busy yards, we are not sure but this is a wise arrangement; at any rate, the account before us states that hand signaling has been practically abolished at Waterloo. It seems that each route has its levers so interlocked that after the switches have been set, and the locking bars and detector bars also properly set, one lever is unlocked, which can be treated by the signal man as *the* lever for that route in either direction. He then decides, by the use of the special selector lever (*R* fig. 4) whether he will pull off his signal for (1) a regular train movement in the normal direction or (2) a switching movement in that direction, or (3) a switching movement in the contrary or "back-up" direction. There are 72 sets of these "three-throw" Simplex arrangements whereby 72 signal levers perform each a triple duty.

The old cabin and frame and the bridge on which they rested were cleared away and the new tower, frame and signals put in use on Wednesday, May 18, the change having been made gradually during the Sunday, Monday and Tuesday preceding. It is stated that the transition stage was passed "with safety and wonderfully little inconvenience to the public." The new frame was

manufactured by Stevens & Son, of Southwark, London.

The yard at this station is sufficiently supplied with cross overs so that every one of the platform tracks may be used for inward trains, and each of the 18 tracks is equipped with "run-in" repeating signals which are electrically interlocked with the lever in the signal tower which works the incoming signals. These repeating signals are 3-position arms, and indicate whether the track is completely vacant or only half vacant. There are small signal boxes inside of the train shed from which these signals are controlled. The men in these small boxes also decide which tracks shall be used by the various trains. They have a very complete electrical apparatus for carrying out their orders, most of the electrical devices being the work of Mr. W. R. Sykes, the inventor of the well known Sykes lock and block system. It appears that the signals to indicate that a track is occupied are not operated by rail circuits, but by means of detector bars and track levers. Mr. Sykes has also equipped some of the semaphore arms with apparatus by which a passing train throws the arm to danger. Each one of the bay or platform tracks has four or more detector bars.



"Simplex" Selector.

Used in Interlocking Machine at Waterloo Station—London & Southwestern Railway.

Sixty-three of the signals operated from Box A are fixed upon an overhead bridge spanning the tracks about 200 ft. from the end of the trainshed, and the same bridge supports the signal box itself. The number of posts on the bridge is 18, every one carrying one or more arms on each side. The arms for switching movements have no lights, but a light for night signaling, governed by the same rod that works the blade, is placed at the *foot* of the post, that is, at the floor of the bridge.

Portable Axle Box Press for Locomotives.

The portable press shown is designed by Messrs. Watson & Stillman for the forcing of the brasses in and out of the boxes of locomotive axle bearings and similar work. The operating power is 20-ton base style hydraulic jack of special make, mounted in the upper platen, with the cylinder and base counterbalanced; and as the operating lever in the regular jack would be too high for convenient manipulation, a special jack is used and a new device is attached to the rods, and at this position the jack is operated the same as it would be at the jack proper. The movement is 12 inches and the full opening between the lower platen and the bars is regularly 18 inches. The lower platen is made 30 by 48 inches and has a hole 4 inches in diameter through its centre for forcing work through it when the plug which fills it is removed. The counterweight is so situated that it is not in the way, and is held in place when moving the press around the shop. The truck wheels are 7 and 10 inches in diameter by by 3-inch face.

Motive Power for Street Railroads.*

After a short review of the various methods of operating street railroads by other methods than animal power, Major. Sears continues with an account of two systems which we give below somewhat abridged:

After careful investigation among a tiresome mass of inventions, some of which show much ingenuity, there have been found two systems which seem to promise, in one form or the other, and perhaps in both, the street motive power of the future. They are, in one case, engines moved by compressed air, and in the other by compressed steam, or water of such a temperature and under such pressure, that when released, it becomes steam, ready for work. The motors for urban use may in both cases be called small packages of condensed power. An advantage of both engines will consist in the fact that they can be built to do a fixed maximum of duty of defined limit, and that this limit is so restricted as to prohibit an attempt to accomplish too much. Thus, the compressed air engine, once charged, is good for a distance of 10 miles without recharging. The compressed steam motor will go 40 miles without reinforcement.

Compressed Air.—A Toledo street railway company after experimenting with the compressed air motor, is so far satisfied with the results obtained that a complete plant is being installed in that city.

Prof. D. S. Jacobus, of Hoboken, saw the system in operation at Nantes and Vincennes, France, where the roads are five and seven miles long respectively, and have been successfully operating this system for twelve years. At the New York meeting of the American Institute of Mining Engineers, held in September, 1890, that gentleman read a valuable paper, which has been published by the Institute, and is the authority for what is here said of the system.

As that paper is accessible to the members of this society, is sufficiently illustrated, and is carefully elaborated in details, only the general facts are here given, touching its construction; leaving it for those personally interested in the subject to study the minor features in the paper mentioned, or on the ground, at Toledo. In the motor car two small engines are connected, so as to rotate the front axle of the car, a reversing lever being used to alter the cut-off and change the direction. The compressed air is held in tanks under the bottom of the car and is admitted to the engine cylinders after passing through a mass of hot water, which leaves the charging station at the temperature of about 300 deg Fahr., and is reduced to 212 degs. when it has returned to that point. The engine cylinders are $5\frac{1}{2} \times 10\frac{1}{4}$ ins. and the compressed air is charged in its retorts at about 425 lbs. per square inch.

Prof. Jacobus estimates the cost of compressed air motive power, as compared with horse traction in Nantes, to be such that if the cost of animal power is put at 100, the cost of the compressed air power will be 63.33. He is of opinion that for a time this power must be limited to localities unencumbered with snow; and believes that for underground service its ventilating capacity will make it of great practical value. This system is also in use at Nagent, near Paris, where each motor draws after it a train of two trailers, at Marseilles, where the cars are operated under a storage pressure of 1,200 lbs. per square inch, and at Berne, Switzerland.

An interesting and fairly conservative account of the performance of the compressed air engine at Toledo, may be found in the *Chicago Street Railway Review* for January of this year. Snow and cold weather seem not to have troubled the experiment, and the old difficulty of frozen air valves no longer exists. The manufacturers claim a trip of nine miles length as the limit of duration of power, and there seems but little chance of increasing this capacity without lengthening the car or raising its floor higher from the street level.

Compressed Steam.—The last mode of applying power to which attention is invited is in the form of compressed steam, and was studied twelve years ago. Later, the invention was laid aside for want of means to improve the original excellent idea; and during the past year, the tendency to recur to some mode of applying steam directly, in the motor, has led to such improvement on the original design that a fair ground of hope exists, that we have, at last, the motor best adapted to urban travel, in what is still known as the Angamar motor, now the subject of experiment in Chicago. Several other plans are also now being proved in that city, viz., the Patton gasoline engine, wherein a portable dynamo is operated by steam and the product transferred to an electric motor connected by the usual method with the wheels; the Judson compressed air engine having three conduit charging stations for each five miles of road; the Belgian motor, which Mr. Yerkes bought in Belgium and has been trying upon one of the North Side roads; a rather small and somewhat complicated locomotive, referred to by the Baldwin Locomotive Works, in their letter following, as being "too small;" the Connolly gas motor, which has inadequate power unless unreasonably large for street use; the Prouty motor, a small steam engine, with inadequate power.

When the writer's attention had been called to the Angamar motor he wrote to the Baldwin Locomotive Works, to learn the opinion of men, who have probably built more street dummies and very small locomotives than any other factory in the world, to learn their opinion of a machine with such pretensions. They replied:

"We believe that such a motor as you describe can be constructed, and that if satisfactorily developed, a large demand will result. Many roads, which are at present operated by electricity, as well as other roads, which are unable to obtain electrical franchises and cannot make the expenditure involved by the cable, will be likely to adopt them. . . . The demand for a steam motor is so strong that, notwithstanding the admitted objections to these machines, we have constructed upward of 300 of them. During the past winter our attention was strongly drawn to the desirability of designing a condensing motor. We built an 18-ton compound motor in which we sought to accomplish the following: (1) To utilize the steam by expansion to so low a tension that its escape from the cylinders would be accompanied by little or no noise, and at the same time such expansion would so considerably reduce the temperature of the escaping steam as to render it easier to condense; (2) To provide a condenser large enough to condense all the escaping steam; (3) To rely entirely upon natural draft, excepting when unusual power was required, in which case the steam could be diverted from the condenser and discharged in the ordinary manner through the exhaust nozzles into the stack. This motor was measurably successful and accomplished the results intended, but we did not succeed in entirely avoiding the show of steam in bad weather. This was probably due in part to the large size of the motor, requiring the generation of so considerable a volume of steam as to render its condensation more difficult. We look for more satisfactory results from a similar experiment with a smaller motor. Meanwhile that motor was purchased for noiseless switching service in Wilmington, N. C., where it is doing satisfactory work. Some time since the North Chicago Street Railway Company imported a Belgian motor, which is said to accomplish all the results which we sought. We have contracted to duplicate it, and, of course, guarantee equally satisfactory results. This motor is, however, too small. We have also agreed to build, from our design, a somewhat more powerful motor with which we have guaranteed equally satisfactory results.

On the strength of various representations, a series of experiments, at the writer's request, have been made with a motor built by the Kinetic Power Co. in Chicago, having the Angamar boiler, the results of which are here presented. The writer places such confidence in them that he has recommended the system to his company as the proper and only solution of the street motor problem in all ordinary cases.

This motor is a contrivance for using compressed steam. Water is heated at a "charging station," to the temperature of 387 deg. Fahr. (200 lbs. steam pressure). This station consists simply of furnace and boiler. A plant of 400 H. P. will be ample for about 100 motors of 50 H. P. each. This stationary boiler is tapped on the low water line for connection with the retort of the motor, and also in the dome. Water may thus be charged above, or steam or the two together when it is requisite to quickly produce the maximum pressure in the retort, which, with all its connections of pipes, dome and firebox, are thoroughly jacketed to prevent loss of heat by external radiation. When the retort of the motor has been charged with hot water and steam, a few shovelfuls of burning anthracite coal are thrown into the firebox.

The example now under experiment in Chicago has a pair of 9 × 10 cylinders; the retort, having a capacity of 283 gallons, is charged with 160 to 170 gallons of water, heated, as already said, to nearly 400 deg. Fahr., and is rated by indicator test at 43 H. P.

By this system it is seen in experience that while the quantity of water in the retort is evaporated and the rapidity of steam-making tends to increase, the fuel in the firebox has been decreasing by consumption in amount and heating power, and thus reduces the tendency to excessive pressure. As the highly heated water is conveyed from the charging boiler to the motor, it first becomes steam vapor and as such enters the retort; but as the injection is continued, a water level becomes established, showing that a portion of the steam under such pressure has returned to the form of water.

The driving wheels are of 31 in. diameter, and thus 1,303 cylinder volumes of steam per mile are used up by each of the two cylinders. Or, the capacity of the cylinders being 636 cu. in., the volume of steam used per mile will be $636 \times 2 \times 1{,}303 = 1{,}657{,}416$ cu. in.

The 160 gallons of compressed hot water contains an energy of 37,000 cu. in. × 1,642, the capacity for expansion, or 60,754,000 cub. in. of steam. If this value were maintained, the motor has a traveling ability of about 37 miles under the charging above mentioned. The actual experience in a course of eight days shows that it may be relied on, starting with 155 lbs. pressure, to make 20 miles without new charging and return to the shop with a pressure of 142 lbs. after such a run, using 30 lbs. of anthracite coal in the trip and carrying 80 passengers on motor and trailer, moving sometimes at 18 miles per hour.

Captain Charles F. Thomas, the Consulting Engineer of the Kinetic Power Company, estimates the cost of power alone per car mile at $1\frac{1}{10}$ cents, which is about one-third the cost of electric power on the West End system of Boston.

Tests of the Standard Car Coupler at the Saratoga Convention.

During the recent railroad convention at Saratoga the Standard Car Coupler Co., of Troy, N. Y., fitted up at considerable expense a complete drop testing apparatus according to the proposed standard drop tests of couplers given in the M. C. B. Committee's report. The apparatus consisted of a 1,640-lb. drop mounted in a suitable vertical frame and raised by a hoisting engine. The foundation consisted of 5 ft. of masonry, 5 in. of timber, bolted together to form one solid floor, and 8 in. of cast iron in a block weighing 2,000 lbs. The tests were

Portable Axle Box Press.

*Extracts from a paper by Alfred F. Sears, M. Am. Soc. C. E., presented at the Old Point Comfort Convention.

open to any coupler company desiring to take part, and also to any maker of draft gear who wished to have his rigging tested An offer was made to any and all who would enter the test that the cost of the couplers broken would be borne by the Standard Car Coupling Company. The Butler drawbar attachment was the only draft apparatus entered for test.

The reason for the non-competition was, perhaps, that most of the coupler makers knew that the foundation under the drop was an honest one and built strictly according to the proposed standard specifications. It makes a more severe test than any foundation previously used and authenticated.

Twenty-six hundred pounds of cast iron and five feet of masonry laid in cement is a pretty solid foundation on which to place 200 lbs. of coupler to be struck by a 1,640-lb. drop falling 15 ft. When this weight strikes there is a dull thud that makes the coupler men sick, and they don't like to enter such tests, particularly as some of the couplers exhibited were made of cast iron.

It was evident from the results of the tests of draft rigging which failed in one blow at 10 ft., and from the opinions of railroad men who examined the apparatus in operation, that the test is much more severe than any service test would be on the shank of the coupler. Tests that have been made heretofore and reported by coupler companies have not been accompanied by a description of the foundation, and although the Standard Couplers that were of sound material stood up well under the severe tests, yet they would have given better results if the foundation had been the same as has been used in some other tests heretofore published. The following are results of the tests made during the convention:

1. A malleable iron bar with a forged steel knuckle. Seven blows, varying from 5 to 18 ft. Coupler uninjured; knuckle opened freely; shank bent ¾ in.

2. A malleable iron bar, with a forged steel knuckle. Three blows at 10 ft. and two blows at 15 ft. Knuckle uninjured, opened freely; back of drawhead cracked; shank broken at centre of length.

3. A malleable iron bar, with a cast steel knuckle. Three blows at 10 ft. and two blows at 15 ft. Knuckle broken in two parts; shank and drawhead broken in several pieces.

A Butler drawbar attachment with a standard Pennsylvania Railroad draft spring was fitted into oak timbers 5½ × 8 in. exactly in the same manner as it is fitted to a freight car. This was placed under a drop with an improved standard coupler having a malleable iron shank and a forged steel knuckle.

First drop, 5 ft., no damage.

Second drop, 10 ft., back end of drawbar attachment broken out and timber cracked, coupler uninjured.

This drawbar attachment is probably as well adapted for withstanding shocks as any other in the market, if not better, and in this case it was particularly well arranged to resist a shock, owing to the careful manner in which it was secured in the oak timbers. This attachment has been tested to 257,700 lbs. in compression.

Several steel and malleable iron bars were tested with the same drop on the foundation, which had been made more rigid by the addition of three inches of cement on top of the masonry and under the bed plate. This foundation was considerably more rigid than the one used on June 15 and 16, although in both cases there were five feet of solid masonry and an eight inch iron bedplate, weighing 2,600 lbs., with five inches of timber solidly bolted together, between the iron bedplate and the masonry. The effect of the more solid foundation was that the bars tested broke under a less drop, but it was evident that the malleable iron bars stood better than the steel ones.

Severe tests were made of cast steel and cast iron knuckles that were put in for repairs by somebody. The cast iron knuckles broke at 5 ft. drop, the cast steel broke at 9 ft. drop. They were not tried at a lower drop, but from the nature of the material and the character of breaks it was quite evident that they would have broken with a lesser drop if they had been tried in that way. These knuckles were all tested when in the proper position in the drawhead. During all the drop tests not one of the forged steel knuckles broke, and but one of the cast steel. That one had been pulled in a testing machine at Fairbanks', New York City, to 114,620 lbs.

In the last test the apparatus was arranged so as to make a guard arm test. The height of drop varied from 10 to 18 ft., striking the knuckle first and then glancing to the guard arm. Under this test the guard arm did not break or fracture, but the shank bent to an angle of about 45 deg. without breaking.

Six-Wheeled Switching Engine—Western New York & Pennsylvania Railroad.

The six-wheeled switcher shown is in use on the Western New York & Pennsylvania Railroad. This engine has a straight boiler 56 in. diameter, with 1⅛ in. radial stays for crown sheet; threads turned off in centre of staybolt. All 1-in. staybolts are drilled with 3/16-in. holes 1⅛ in. deep. The top row of staybolts around the firebox are 1½ in. with ¼-in. hole 1¼ in. deep. The firebox is 66 in. long and 34 in. wide, made of Otis steel; side and back sheets 5/16 in. thick, crown sheet ⅜ in. thick and tube sheet ½ in. thick. The engine is equipped with a balanced poppet throttle valve, two 3-in. Coale muffler safety valves, and two monitor injectors, a No. 7 on the left hand side and No. 8 on the engineman's side; Nathan sight feed lubricators and set valves placed in bridge pipe for lubricating cylinders. The grates are of the rocking pattern, the company's standard. The locomotive has a straight smokestack and Laird guides, lower bar 2½ × 5 in., upper bar 2½ × 7 in. The crossheads are cast steel with brass bearings. The engine and tender are equipped with the American Brake Company's steam

Six-Wheel Switching Engine—Western New York & Pennsylvania Railroad.

driver brakes. The sand box has double openings for front and middle wheels. All wearing brasses are made of seven parts ingot copper and one part tin. The tank has a capacity of 2,900 gallons.

The principal dimensions are:

Cylinders	19 in. × 24 in.
Slide valves	Richardson balanced.
Travel	5½ in.
Outside lap	¾ in.
Inside lap	1/32 in.
Drivers	50¾ in. diam.
Tires	3½ in. thick.
Driving wheel base	10 ft. 10 in.
Total wheel base	36 ft. 6 in.
Weight on drivers in working order	98,000 lbs.
Weight of tender with fuel and water	68,000 lbs.
Boiler—diameter at waist	56 in.

Tubes, 180 in number, lap welded, charcoal iron, No. 12 W. G., 2 in. diam., 13 ft. 9 in. long.
Tender trucks are centre bearing, Lobdell chilled iron wheels, 30 in. in diameter.

The Flood on the Western New York & Pennsylvania.

The account published in the *Railroad Gazette* last week of the damage to railroads in Western Pennsylvania by the floods and fires of June 4 and 5 should be supplemented by the following report of the damage on the above named road.

The roadbed between Corry and Oil City was damaged to such an extent by the storm of June 4 that nothing but construction trains was run for seven days. Regular train service was resumed on Sunday, June 12. At McClintockville, near Oil City, an abutment and pier of a new two-span iron bridge were undermined, and one span of the bridge fell on its side into Oil Creek. One end of the other span dropped into the creek. At Nobles, on Union Branch, a Howe truss bridge was washed from the abutments and lodged on its side some distance down Oil Creek. At Titusville and Pioneer piers were undermined. Some 800 or 1,000 ft. of trestling and embankment was carried away at various points, some of the gaps being 200 ft. long and 40 ft. deep. Several thousand feet of low roadbed was washed away, and the track carried to one side or turned up on edge, and covered with logs and rubbish of all descriptions. Where the roadbed bordered on the creeks it was badly washed and undermined at the sides. At Titusville the freight station was burned, together with its contents; also 35 freight cars, 2 passenger cars and 1 baggage car. At Oil City 15 freight cars were burned and a switching engine badly scorched by the explosion of gasoline and burning oil on the creek. The floor of the iron bridge at Oil City was somewhat damaged by the oil fire. Two steam shovels, eight construction trains and a large force of carpenters and laborers were put at work as quickly as possible, and the road was put in condition for traffic in six working days. During the first two days but little could be done by reason of the continued high water. During the first part of the week the Pittsburgh through trains were run over the Buffalo and River divisions via Olean and Oil City until the Philadelphia & Erie track between Corry and Irvineton was made passable. After that they were run via Corry, Irvineton and Oil City. The loss by fire was largely covered by insurance. Several trains were caught between the washouts, but no engines or cars were ditched or even derailed.

Fall of the Licking River Bridge.

We have received a report on the fall of the false work of the bridge over the Licking River between Newport and Covington, but hold it until engravings can be prepared. So far as can now be judged the destruction would have been much less if the false work had been properly braced longitudinally.

The Baird Brothers, who had the contract for erecting the superstructure, were a remarkable group of men, and have made a reputation in a novel and difficult field of work. William, who survives, and Andrew who was drowned in the Licking River accident, were, we believe, the members of the firm, but Robert, who was also drowned, and John have long been associated with them in the work of erecting. They were Canadians, and came to the United States in the employ of the Keystone Bridge Company. Andrew was the first to come. The story goes that he showed such capacity that he was asked one day if there were not some more of the family like him. "Yes," he said, "there are three better men." The result was that the others finally came to the employ of the Keystone Bridge Company. From employés they became contractors and have been connected in one capacity or the other with the erection of many of the greatest bridges built in the United States in the last 20 years, from the Eads bridge at St. Louis to the great Memphis bridge. Among other bridges erected by them were the Kentucky River Bridge, the Merchants' Bridge St. Louis, the Poughkeepsie Bridge and the Thames River drawbridge. These are but a few of the largest.

In 1888 they erected for the Union Bridge Co. the Cairo Bridge, 10,494 ft. long, in 52 spans. There they erected one span 518 ft. 8 in. long in four days. The span weighed 2,055,200 lbs. This included handling all of the steel from the yard, erecting the trusses and putting in the top lateral bracing. The floor system and bottom laterals were not included in the four days' work. This still stands as the record for speed in erecting, so far as we know. This was the second channel span. The first, of the same dimensions, was erected in six days. The false work used in the first span was used again in the second. The first span was erected, the false work taken down, the piles drawn and driven again, the false work put up, and the second span erected in one month and three days. Of this time five days were lost waiting for masonry. The engineer and practical bridge builder know that speed in erecting is not a mere matter of display. It is a means of economy and may be a very important one. When a bridge costs $1,000,000 the interest account is big enough to make the days valuable; but it is sometimes of still greater importance to get obstructions out of a navigable stream, or to get the work out of danger from high water. So, such exploits as that at the Cairo bridge, in developing the art of bridge erecting, have a commercial value far beyond their value as advertisements for the contractors. We suppose that no one else has done so much to create and develop this art as the Bairds.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The question of test loads for bridges is again up with some German engineers, and on another page we give a synopsis of an opinion recently published by one of them. Doubtless the value of test loads is sometimes overrated in this country, but we judge that among our engineers, if not among the railroad managers, there is not much misconception of the relative place of testing by loading and of inspection in detail. In fact a test load may be a useful adjunct to bridge inspection, if not mistaken for the inspection itself. The danger of the use of test loads is that they may be taken as a demonstration of the strength of a bridge, when, as a matter of fact, the bridge may show no abnormal deflection, yet may be almost at the point of failure. Every engineer who has had much experience in bridge inspection can tell instances which prove this. It is doubtless true that bridges have been wrecked by the failure of a part, the weakness of which would have been found by a competent inspector but which might have shown no reason for apprehension under a test load. It is also very probable that the test itself has sometimes started a crack that has afterward caused the destruction of a bridge under a train, although this would not happen in a modern, scientific bridge. A flexible bridge does not necessarily mean a bridge deficient in strength, though every good railroad bridge should be a stiff one, since all motion of parts wears material and increases strains. It is for this reason that the Post truss, though now unpopular on account of ambiguity of strains and antiquated details, has outlived other types, built at the same time and for similar loads. In the Post truss, the counters extended to the abutments, and literally tied the bridge down to prevent motion. It is for a similar reason that a well built plate girder is the most permanent type of iron bridge that can be built, and is more economical than less costly truss spans. The test load is useful in proving the proper adjustment of parts, and their action under passing trains. Good bridge inspection, however, should not wait for test loads to reveal serious defects. They will not always do it, and therefore to depend upon them is worse than to use no loads at all.

In another column will be found a review of the subject of electric and steam traction for suburban and through lines, not meaning by this street car line traffic. The writer reaches the following conclusions:

1. There is no prospect of electricity replacing steam for long distance freight traffic.
2. There is a possibility of electricity becoming an economical substitute for steam locomotives for high speed service wherever the traffic is sufficiently heavy and constant to warrant the construction of lines of track independent of those used for moderate speeds.
3. There are very few localities in the United States in which the conditions are such as to make such a substitution commercially possible, with the efficiencies at present obtained with electrical machinery.
4. If the electrical equipment could be purchased at reasonable prices, there are a few short lines of steam railroad on which the passenger traffic is such as to make electricity a possible form of motive power at present speeds.
5. It is probable the electric locomotives will be used in tunnels and for switching in cities where freedom from smoke is important.
6. No electric motor capable of doing the work of a medium weight steam locomotive has yet been constructed.

The first conclusion is evident from the fact that the cost of the conductors for the electric current and the loss on the long lines due to leakage and resistance would more than offset what might be gained in the fuel saving. The second conclusion is also evident except that part calling for independent tracks and for high speed traffic. Why the traffic must be independent is not clear, as all that is needed is a clear track, and that can be had with a slow or high speed trains if proper signals are provided. Just what the speed has to do with the matter is hardly clear, as the velocity of the motor armature can be widly varied without changing the velocity of the driving wheels. Perhaps a constant speed may be an essential condition, but it may be high or low and yet be constant. The speed along the track is one thing, and the speed of the armature quite another. A high velocity of armature can be had by using small drivers or a reducing gear between the armature shaft and the driving shaft. We believe that the third conclusion is becoming more evident daily, but no satisfactory calculations have been made to show its truth. This applies as well to the fourth conclusion. The correctness of the fifth conclusion is obvious. The sixth conclusion shows the funny part of the whole discussion of the possibilities of the substition of electricity for steam on suburban roads. So far the electric construction companies have been simply talking, and in that they contrast strongly with makers of other mechanical innovations, who do, as a rule, make a try at a job at least before they talk of the wonderful possibilities of their devices. But to do them justice we should say they are working in good faith, only they prefer that some one else should pay the cost of making expensive experiments. The Baltimore & Ohio tunnel job will give them a chance to show what they can do, as the horse power required to haul the proposed trains at the proper speeds up the given grades, viz.: 1,200 tons at 15 miles an hour and 500 tons at 30 miles an hour up a 42-ft. grade is about 950. This is certainly enough to commence on.

Obviously the Master Car Builders' Association's days of usefulness are not past. On the contrary, from year to year new matters come up, or more often new phases of old matters, and are met with ability, and it is probable that for many years to come this will continue to be true. The influence of the Association grows rather than declines. One has only to watch the progress of practice on the railroads, and the public discussions on legislative control of safety appliances to see this. But this fact makes the responsibility of the Association all the greater; and no doubt the knowledge that the work of the Association is gradually raising the standard of practice in a multitude of details, and that its investigations and decisions are watched by many students of railroad economics who are not railroad men, acts as a constant stimulus to the leading minds in the Association. The dignity of the body and its wide influence in important affairs ought to be kept constantly in mind in the work of the committees and in the discussions and votes of the whole Association. These thoughts are not new to those who have watched and in some measure guided the career of the Association; but they are suggested afresh by reading the report of the Committee on Standards of Efficiency for Air Brakes. The report shows that the members of that committee, as well as some other members of the Association are alive to the changed conditions, and indeed, we might say, to the dangers of the present situation in air brake practice. The report might very profitably have stated these dangers at greater length. The Committee hints at the fact, which we have often felt obliged to mention, that there are at this moment triple valves offered which the makers doubtless believe to be thoroughly efficient and reliable, but which in fact cannot perform all the functions of a quick-acting triple, and which are positively dangerous if used on long trains. The further fact is pointed out that even a brake expert may be deceived in a new form of triple valve unless he subjects it to actual and comprehensive tests. It is suggested, therefore, that the Association formulate and adopt a set of standard tests and requirements; that there be a permanent and complete testing apparatus established where comparative tests may be made, the results of which may be safely accepted by the railroad companies. It is gratifying to know that one of the practical difficulties in carrying out such a plan is met by the Pennsylvania Railroad which offers to establish the necessary apparatus at Altoona, and to "give every facility for furthering these investigations." It is still true that a good many railroad officers will think that they can select and test their own brakes without the help of the Pennsylvania Railroad or of the Master Car Builders' Association; and so some of them can, but there are others who will learn in that slow and costly school, so much frequented by their kind, that the air brake is an expensive thing to fool with.

The Train-Dispatchers' Association, which held its annual convention at New Orleans last week, is considerably exercised over the question of "protection"—the question whether the constitution shall be so modified that the Executive Committee can order a strike whenever a member has been misused by the railroad company for which he works. This would seem to be too delicate a question to receive much consideration in a society like this; one with such comparatively small representation on any one road, and composed so largely of men who have *almost* reached the goal of their ambition—promotion to an official position, but it seems to have been persistently brought forward, nevertheless. The conservatives won the day, however, and apparently with ease, but the question was settled in a way that is rather odd. The resolution that was adopted says:

> When a member has been wrongfully dealt with by his employer, and upon complaint being made to the Chairman of the Executive Committee, an investigation of the facts shall be immediately instituted by the Chairman, and the Executive Committee shall have full power to act in a conservative manner in the matter, but if they cannot adjust the grievance they shall formulate a complete statement of the grievance under investigation, and submit the same, with an appeal to the American Society of Railroad Superintendents at their next meeting thereafter, for their co-operation and assistance as a mediator in adjusting the wrong done to the train dispatcher.

The Superintendents will probably not appreciate the honor very highly. A superintendent finds it hard enough to have to deal with the grievances of his own men, and will not take much pleasure in gratuitously discussing other people's quarrels. It is true that the constitution of the Superintendents' Society provides for "seeking out the best practice and the highest standards of excellence" in railroad operating, and that questions concerning overwork, or poor pay or harsh treatment of a dispatcher may bear so closely on this question as to be a legitimate subject for discussion; but we venture to predict that they won't be discussed much; and subjects not susceptible of profitable discussion can hardly be regarded as properly coming within the scope of a society whose chief aim is the interchange of individual opinions.

Notwithstanding all this, it would be a good thing if the superintendents could frankly discuss certain matters concerning the conduct of train dispatchers' offices, which are closely connected with the grievances which these dispatchers have, or expect to have. They are matters which ought to be aired whether dispatchers feel aggrieved or not. For instance, suppose the chairman of the appropriate committee should ask each member some one or all of the following questions: Why do you employ such young persons, almost boys, as dispatchers? Is it chiefly because they are satisfied with lower pay than more experienced men would accept? Why do you let these comparatively inexperienced dispatchers run their offices so entirely according to their own notions, instead of following them up so closely that they will be compelled to follow the rules rigidly every day? Why do you work a man at dispatching eight hours a day (on a wire where that amount of work is enough for one day), and then have him work an hour or two at other work? Is that fair? What do you think of appointing, to a position like this, a man who knows nothing about good discipline; who knows neither how to command nor how to obey? Orders have to be given every day to enginemen and conductors who have grave—yes, exciting—responsibilities, and who ought to be treated with the consideration due to gentlemen; you treat them as gentlemen yourself, as a matter of course; do you take care to see that the dispatchers do the same? Probably you can tell of some of your neighbors' roads where dispatchers are overbearing, or childish, or ignorant, constantly annoying the trainmen. Do you investigate all the butting collisions that you hear of, and find out about the dispatcher who—though the blame is, according to the rules, laid upon the trainmen or operators—might have prevented the blunder that those men made if he had only exercised the ordinary degree of foresight that any experienced conductor or engineman would have exercised? These are some of the questions which a good many superintendents would like to see asked. They would take great interest in the way different members answered them. Butting collisions constitute the most

From East End of South Upper Veranda, Looking West.

From the West End of the North Upper Veranda, Looking Eas

From the East End of the North Upper Veranda, Looking Southw

Note.—The display of railroad material and apparatus at the conventions of the Master Car Build

M. C. B. Drop Test Apparatus – Standard Car Coupling Co.

g East.

Southwest.

The Exhibit of the Pintsch Light.

ILLUSTRATIONS FROM PHOTOGRAPHS SHOWING THE ARRANGEMENT OF EXHIBITS AT THE SAR

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Looking East.

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reproductions of which appear above.

Balcony of Main Upper Veranda.

Main Upper Veranda Looking South.

Main Upper Veranda, Looking North.

OGA CONVENTIONS.

tended recent conventions some notion of the magnitude of this display, the *Railroad Gazette* caused the photographs to be taken,

notable disgrace to American single track railroads, and the dispatcher's office should be made perfect on every road. The highest attainable human perfection may not afford the requisite safety with the present dispatching plan—which, as a plan, is probably the best that can be devised—but the effort to reach a high mark will serve a good purpose, nevertheless. It will show in a clearer light the need of supplementing the best dispatching system by a block signal system, as a number of roads have done.*

Convention of the Master Car Builders' Association.

The Twenty-Sixth Annual Convention of the Master Car Builders' Association at Saratoga last week, the proceedings of which will be found in this issue, was marked by an unusually large attendance, ample accommodations for the members and the general smoothness with which all the meetings and arrangements were carried out. The papers presented and the reports of the committees are usually good and useful. Those on the "M. C. B. Automatic Coupler Standards and Limits," "Standards of the Association," "Standard Tests of Air Brakes," and "Air Brake and Signal Instruction," are not only of great value to the Association, but are valuable for their scientific merit. These papers compare favorably with those of any other mechanical or scientific association in this country and give evidence of more care in preparation than is generally given to papers read before our engineering societies if one is to judge by the value of the result.

The report on the automatic coupler and the proposed standard tests is, next to the standard tests of air brakes, the most valuable. If the provisions of these reports are carried out, and railroads buy brakes and couplers strictly to the specifications given, the results will be what are now sought, not only by the railroads themselves, but by the public generally, the introduction of a safe coupler and air brake, not alone for passenger cars, but for freight cars. As long as tracks are used for both freight and passenger trains the public have a direct interest in the airbrakes and couplers used on freight trains, for a wreck in a freight train may take place while passing a passenger train, or such a short time before meeting a passenger train, as to cause danger to passengers.

No doubt the tests for couplers will be changed somewhat after they have been tried for a time, and enough tests have been made to learn whether it is practical to make couplers to meet the tests. It is probable that the pulling limit will be raised and the drop test reduced, as, from our present knowledge, they seem to be disproportionate.

What Mr. Rhodes said about tests of individual triple valves (given in the report of the proceedings) shows how much can be done to determine the value of an air brake from an examination of a single triple valve with little expense. Mr. Rhodes' interesting investigations were carried on with a single triple valve, and his results show that it is possible to distinguish a good from a bad triple if the badness lies in one of the several features of operation. Of course there are other ways in which a triple can be unsafe to use that would not be shown by the tests made by Mr. Rhodes, but as far as the general operation is concerned, leaving aside errors in workmanship and mechanical design, such tests will show approximately how closely any triple will conform to the proposed standards of the Association.

The report on air brake and signal instructions will be of great value to any railroad company that will follow its directions. Only those who are intimately acquainted with trainmen and engineers know how dense is the ignorance regarding the automatic air brake and its operation. Besides ignorance, there is a lot of dangerous brake lore common among the more ignorant, the teachings of which is dangerous to follow. This misinformation can be corrected by the extensive circulation of the "Air Brake and Signal Instructions" when printed by the Association. Perhaps the practice of issuing brake instructions to engineers, fireman, trainmen, requiring them to sign a receipt for the instructions, and later on demanding some evidence that the instructions have been read, as followed by some railroads, is the best way to distribute an accurate knowledge of the use of air brakes.

It is noticeable from the changes in the Rules of Interchange that the value of freight cars is increasing. This results partly from better design, better workmanship and the higher cost of the material used. The addition of $25 to the allowance for 34-ft. box cars is very desirable just now, as it will assist in the introduction of better draft rigging, and perhaps encourage the use of steel centre sills. The addition to the list of parts chargeable to owners of cars perhaps emphasizes the disapproval of railroad companies of the use of private cars and of the charges now made for mileage.

From the reports and discussions it is evident that considerable progress has been made in the manufacture of cast iron wheels during the past two years. Nothing has been added at this convention to the knowledge already possessed about steel-tired wheels, but perhaps a disapproval of bolted wheel centres is indicated.

The report on the standards of the Association, outside of the excellence of its arrangement, preparation and recommendations, is decidedly disappointing and uncomplimentary, not to the committee which prepared it, but to the members of the Association. This appears from the fact that regarding such an important matter only 49 replies were received out of the possible 287. This shows a lack of appreciation on the part of Master Car Builders' of the value of standards, and it might be worth while for the management of railroads to stir up the car department a little with a view of inducing a fuller appreciation of the only way in which the cost of repairs to freight cars on foreign and home roads can be greatly reduced. The subject has been continued for another year and it is to be hoped that members will reply to whatever circulars may be issued in the fullest manner possible in order that the real value and the extent of use of present standards may be determined.

There is of course no possibility of obtaining uniform braking power without some reasonable uniformity in the friction of brake shoes, yet this last can only be had by gaining something like uniformity in the material used for brake shoes. The Committee this year had so much of more pressing importance to attend to that it could not take up this important subject and the non-action this year, with regard to this subject does not reflect in any way on the Committee, as the Association should be well pleased with the work done on the standard tests of air brakes. The coming year the subject of brake shoe material is to be allotted to a new committee, and it now stands as one of the most important subjects for investigation.

This year the Executive Committee has taken a decided stand about the presentation of patented devices, in reports placed before the convention, in accordance with the constitution which provides that, "No patentees or their agent shall be admitted in the meetings of the Association for the purpose of advocating the claims of any patent or patentees unless by unanimous consent." However, the rulings of the Executive Committee were hardly consistent, as it ruled out pressed steel centre plates and stake pockets, but admitted a patented pressed steel truck and a patented steam coupling. Of course the use of the coupling was an oversight, and the cuts have been ordered to be changed to remove any reference to the patented device. In matters of this sort, to do justice to all, the Association should have a fixed plan to be followed without exception in all cases.

Taken as a whole, the members of the Association cannot be otherwise than highly gratified with the labors of its committees and the success of this Convention.

Legislative Control of Live Stock Transportation.

A bill has been introduced into Congress to amend the existing law concerning the transportation of live stock which limits the time during which animals may be confined in railroad cars or vessels without food or water to 28 hours. The bill substitutes for this period 42 hours, and is, so far, judicious. Yet it might be better to repeal all legislation on the subject, leaving it to the courts to repress any unnecessary cruelty when a case should be made before them, as they could do without this law. This is one of the many instances where past legislation based on insufficient knowledge has done more harm than good, and where a repeal of the whole law, leaving the business untrammeled would possibly do more good than harm.

There are many facts to be considered affecting the transportation of live stock which cannot be known by any except those who have had long experience in the business and who have given the subject interested attention. Even if the shippers were a brutal class of men, without humane sentiment, their business is now conducted on so large a scale that an ordinary regard for their own interests or profits would compel them to take every precaution to avoid unnecessary discomfort or injury to the animals which they must wish to deliver to the market in the best possible condition. But an acquaintance with some of the larger shippers, who have been in the trade the longest, permits us to state from knowledge that they are as little likely to tolerate cruel practices which they can prevent as the agents of the Society for the Prevention of Cruelty to Animals would be.

We understand the theory of one of the wisest of these old shippers to be, that the ox, for instance, is a sensitive creature, attached to home (certainly the stall-fed ox knows his "master's crib," from of old); that from the time he leaves home on his way to market he is depressed in spirits and his food is not digested: the corn he eats in Chicago is found in him whole, or voided undigested, after he has reached New York. Therefore, the kindest thing you can do for the ox which is destined to the shambles is to hasten his transit from the pasture to the block.

If the cattle are not too crowded in the stock car, a part of them can and do lie down. When they get up others lie down, and their transit, sheltered from the sun and with a pleasant breeze kept up by the motion of the train seems to be very comfortable indeed; even in winter they do not seem to suffer while in the cars. It is different, however, when they have to be unloaded or reloaded—unloaded in a strange place, surrounded by unknown things, shouted at by a new set of barbarians, goaded behind because the animals in front do not advance rapidly enough, driven into wet, muddy yards to get a bite of feed and a drink; then on being reloaded to be assaulted again with fierce cries and goads, and their tails twisted to make them crowd their way into the obstructed car. If the poor creatures knew they had been put to all this extra torture in the name of humanity and to satisfy the sentiment against cruelty to animals, they would be justified in moaning, "Save us from our friends!"

This case of neat cattle is peculiarly hard because they seem more intelligent than the other kinds of beasts which are the subject of transportation in mass. As for hogs and sheep, if they are not too much crowded, and are well watered by sprinkling in hot weather, as all through lines are now fitted up to do, they will suffer less by lying in their sleeping cars than by being driven out of them and back again in the sun. With hogs any loading or unloading must be in daylight, because they cannot be got to move in the dark; and this frequently compels hogs to lie all night in the cars at the point of transhipment, to be unloaded and reloaded in conformity with the present legislation, when they might have been in transit and half way to their final destination, if not required to be unloaded after a specified number of hours in the cars.

It would be easy for experts to suggest some legislation which would improve the comfort in transit and lessen the hardships at the stockyards of the animals on the road to market. Chief among the important provisions of such laws would be one requiring plenty of room, so that the animals could lie down and get up safely, and one forbidding, instead of compelling, frequent unloading. It is probable that competition between roads, aided by improved appliances, air-brakes, etc., will render it practically unnecessary to unload animals between Chicago and the Atlantic seaboard, if they are kept in motion and make as good time as is practicable. It is certain that the time will be better employed for them in rapid transit than in unloading and reloading, subject to the miseries of the stockyards.

The Master Mechanics' Convention.

The twenty-fifth annual convention of the Master Mechanics' Association at Saratoga marked a step in the progress of locomotive construction in two ways,—one the approval of the compound locomotive, the other the approval of higher locomotive boiler pressures. Perhaps another might be added relative to the knowledge obtained from steel manufacturers about the cost of and tests of firebox steel.

It would appear from the discussion that there are about 200 compound locomotives in service doing good work and in a way that permits them to be used in any kind of service with the manifest advantage of having greater endurance on long grades, greater hauling power in bad places and a saving of about 15%, as shown by the admirable report of the committee on compounds. This is an average saving and we should be prepared to believe reports of greater saving when the engines are worked to their full capacity and of less saving in light express work.

Higher boiler presures are now so commonly used that it is no longer a novelty to hear of engines using 200 lbs. boiler pressure. The boilers for this work are made of thicker sheets, the staybolts are larger in diameter and are placed closer together. The joints in the shell are butted with welts inside and out, crown bars are avoided and screw stays are used instead.

It was pretty clearly shown that a good firebox steel will be low in phosphorus and will bend at a blue heat without cracking, although this last is yet a some.

*One of the most interesting applications of the block system to single track working, that on the Baltimore & Ohio, was described in the *Railroad Gazette*, of Oct. 30 last, page 763.

what disputed point. The association has learned something about laminations in firebox steel, their causes and how protection may be had from the losses resulting from laminated sheets. It appears from the discussion that the present prices for steel are sufficient and that the quality is but little affected by the price.

At last the Master Mechanics' Association has approved of the vertical plane coupler and of the action so far taken by the Master Car Builders' Association.

Taken altogether the recent convention has been a profitable one to all who have attended the meetings, and will be so to those railroad men who will take the trouble to read the reports and discussions thereon.

The special Commission appointed by the General Term of the Supreme Court of the State of New York to examine the plans of the Rapid Transit Commission, has made a favorable report. The Commissioners decided that it is feasible, and in the public interest to build the road on the lines and according to the plans laid down by the Rapid Transit Commission, except that portion of the road under Madison avenue from Forty-third to Ninety-sixth streets. They are of the opinion that construction can be carried on by a shallow tunnel and open cuttings without danger to the existing foundations. They say that if any damage results from the construction or operation of the road a liability will exist in favor of the injured property holders as against the corporation constructing and operating the road, and that the Board of Rapid Transit Commissioners is called upon to protect the interests of the city by requiring a deposit in cash or approved securities. The Commissioners think that the road can be built, and ready for operation in three years, and that the system can be successfully operated by electric motors. They think also, that satisfactory bidders will be found for the franchise. If the Supreme Court now affirms the finding of this special commission, the next step will be the preparation of detail plans and specifications, and then the franchise will be put up for bids. Notwithstanding the opinion of the Commission, we regarded it as very doubtful if satisfactory bids will be obtained, but we recognize the perils of prophesying on such matters. Probably the decision of the Commission was the most prudent one that it could make, for no doubt the public would not have been satisfied by anything short of an actual effort to finance the project.

A local correspondent writes as follows concerning the Baldwin locomotive squabble in New South Wales: A Royal Commission is sitting to determine the truth of certain charges made there by a member of parliament that the Baldwin locomotives recently imported are unsuitable for the road, and have failed to do the work expected of them. Over 50 witnesses have been called in support of these charges, but their testimony is curiously enough (!) overwhelmingly in favor of the engines, which are the most powerful ever imported into Australia. The Railway Commissioners are defending the case and are understood to be well satisfied with the work done by the engines. The case is still proceeding, and as yet only one witness has been examined on behalf of the engines. Trials of the passenger engine took place on the Sunday before the mail left, and it is stated that a load of 120 gross tons was hauled up a grade of 176 ft. per mile in 12 minutes, the schedule time being 17 minutes. Other particulars are not yet made public, but are understood to be equally satisfactory. Numerous indicator diagrams were taken and the results of the trial are to be fully worked out and will doubtless prove of much interest.

NEW PUBLICATIONS.

The Railway Officials' Directory. The Railway Age and Northwestern Railroader, Chicago, Ill.

The purpose of this little book is sufficiently indicated by its title. It contains a list of railroad officers, including, however, nothing below the rank of Division Master Mechanic, so far as we have observed. Although there are many such lists published, this one has certain advantages that is, it is only 3¼ × 5½ in. in size, and is all contained in 176 pages. Therefore it is very convenient not only to carry, but to use. We have discovered quite a number of errors in it, but, on the whole, it is reasonably accurate.

TRADE CATALOGUES.

Two Cylinder Compound Locomotives. Schenectady Locomotive Works, Schenectady, N. Y., 1892.

In a pamphlet of 44 pages this company publishes a short description of the two-cylinder compound locomotives built by it, and the description is very well illustrated. Naturally, there is but little that is special to describe, except the intercepting valve. In the introduction, it is said that the compound locomotives built by this company have developed an economy of from 15 to 30 per cent. over similar simple engines, and it is found that the cost for repairs is actually less as the increased life of firebox plates and tubes more than compensates for the cost of maintenance of the special parts. The pamphlet begins with a reprint of Mr. C. H. Hudson's paper before the Western Society of Engineers, telling the experience of his road, the East Tennessee, Virginia & Georgia, with the two-cylinder compound. This matter we have already published. There are illustrations of several of the ten-wheel compounds built by the Schenectady Works, and of a twelve-wheel compound built by them for the Southern Pacific. The engines are illustrated in perspective, as are the ten-wheel passenger engine for the Pennsylvania railroad lately shown in the *Railroad Gazette*, and a ten-wheel passenger engine for Dr. Webb's new Adironkack & St. Lawrence Railway. Several indicator cards are given.

Power Pump and Their Applications. The Goulds Manufacturing Co., Senaca Falls, N. Y., and 16 Murray street, New York City.

This is a very pretty pamphlet showing various examples of Triplex and other power pumps to be operated both by electricity and steam. The necessary information for purchasers is given. A number of illustrations from photographs and drawings show applications of these pumps to a great variety of uses.

The John A. Roebling's Sons Co. sends us a small catalogue dated May 1, 1892, containing illustrations and particulars of their varied product. In the catalogue will be found iron and steel wire ropes adapted to a great variety of uses; also wire rope fastenings of many kinds. Hoisting wheels, tackle blocks, telegraph wire and wire netting are also among the materials described. The pamphlet contains some short but useful articles on transmission of power and cable ways.

The Convention of the Master Mechanics' Association.

The twenty-fifth Annual Convention of the American Railway Master Mechanics' Association convened at Saratoga on Monday, June 20, 1892, at 9 a. m., President John MacKenzie in the chair.

The President in his address said:

We now have representatives of the mechanical departments of nearly every railroad on the North American continent. The increase of membership during the last five years has been phenomenal. When we met in St. Paul, in 1887, there was a total membership of 270. Since that time 241 names have been added to our roll, making a total membership at this time of 511. There has been a steady improvement in the quality of the reports submitted by our committees, and this year the reports are notable for the amount of original investigation presented. Some of the papers are as valuable scientific documents as have ever been submitted to any scientific organization.

The roll call showed there were about 150 members present at the opening session.

The secretary reported that the money received during the year amounted to $3,014.50. Of this sum $1,010 was received in the printing fund, $1,960 in dues and $44.50 by sale of reports.

In obedience to a resolution adopted at last convention the American Railway Master Mechanics' Association is now an incorporated organization.

At the last convention a committee was appointed to draw up the necessary papers for transferring the Boston Fund to the Stevens Institute of Technology, Hoboken, N. J., in the purchase of four scholarships for the Association in that institution. The necessary papers were duly prepared, and the custodian of the fund paid $8,000 to the President of the Institute and the contract conferring the scholarships upon the Association was issued, and is now in the hands of your secretary.

On motion of Mr. J. H. Setchel the following resolution was adopted;

Resolved, that all car builders above the rank of general foreman, having charge of the design, construction or repairs of railway rolling stock, are eligible to membership to this Association.

A letter was received from the American Society of Railway Superintendents the same as the one read before the Master Car Builders' Association which was mentioned in these columns last week.

The communication was received and referred to a committee who reported later that that they were unanimously of the opinion that the Association should send two delegates, and the Convention then elected as delegates Messrs. J. N. Lauder and John Mackenzie.

On motion of Mr. Setchel it was

Resolved, that all questions pertaining to the repairs, construction, or designs of the rolling stock of railroads, whether of engines or cars, are legitimate questions to come before this Association.

On motion of Mr. Pulaski Leeds the name of Mr. H. L. Cooper was placed upon the honorary list.

The Committee on Standard Tests for Locomotives reported that as a like committee has been appointed by the American Society of Mechanical Engineers, a number of that committee being members of this Association, it was suggested by them that we hold a joint session and prepare a joint report. This seemed a desirable thing to do; and we ask the Association to instruct the Committee to confer with the Committee of the American Society of Mechanical Engineers, with a view of making a joint report. On motion of Mr. Roberts the Committee were requested to make the joint report suggested.

REPORT ON COMPOUND LOCOMOTIVES.

This is a long and very valuable report, and we reserve the main body of the report for a future issue, meantime giving the following tables upon which most of the discussion was based.

Mr. GEO. GIBBS (Chairman): Trip No. 18 is very much more economical than any other one obtained with the compound engine, and obviously does not represent an average result. The reason for that extraordinary economy is shown by reference to the tables. That train was a through light train, with no stops. I think it was made on a Sunday, with a clear track, and the conditions were very favorable. There was no switching done. It was, therefore, a very economical train load.

On the simple engine there was an uneconomical performance shown by trip No. 3. That was a way freight, did a large portion of the work in switching, and therefore an uneconomical work. If the curves given with this report represent fairly the results at any one point of loading, it will be seen that the compound engine is not only more economical than the simple one, but it holds its economy longer than the simple engine.

On motion of Mr. J. N. Barr the committee was continued another year.

Mr. S. M. VAUCLAIN (Superintendent Baldwin Locomotive Works): Last year we had taken orders for upward of 40 compound locomotives, and I then said that if the demand kept up at the same rate before the end of the year we would have orders for 100. Before the end of the year we had orders for 160, and at the present time we have over 200 in service and a number of others are under construction. This is four or five times the number that have been built by all other manufacturers in the United States. The test that has been made on the C., M. & St. P. road should settle forever that there is an economy in compound locomotives. The percentage of economy that is given by that test is perfectly acceptable to the Baldwin Works, and we think that Mr. Gibbs, who has been in charge of that test, has being untiring in his efforts to arrive at a result that would be acceptable to all railroad people in this country. We look for economy with the compound locomotive, in accordance with the service they are put to. We have spent between $30,000 and $40,000 in making tests and we have a corps of men traveling in the interests of our engines and making tests where they are desired. Reports from 15 to 20 different roads show a saving all the way from 1 to 44.9 per cent. Now 44.9 per cent economy in a compound locomotive means something, and that something is that both engines were worked to their limit of power. This report was made to us by the Western Maryland Railroad. The only explanation of such a high rate of economy is that both engines were worked as near full stroke as possible. We have built compounds from 23 in. gauge up to 5 ft. 6 in., and all sizes, from a 4 in. to a 28 in. cylinder. Our system is applicable to all types, from the smallest to the largest. We have to-day running on the Erie five locomotives that, were they plain engines, no man could fire them at all. The boilers are 76 in. in diameter, and they are reported as doing the work of two consolidation locomotives on the grades where they are running. We have also built compounds for high speed passenger service. We built one and

TABLE VII.

CHICAGO, MILWAUKEE & ST. PAUL RAILROAD—LOCOMOTIVE TESTS.

Table of Percentages of Saving by Use of Compound Engine.

Conditions.	Line No.	Train results. Coal per ton-mile.	Train results. W't'r per ton-mile.	Dynamometer results. Foot-tons per lb coal.	Dynamometer results. Foot-tons per lb w'ter	Dynamometer results. Coal per h. p. per hour.	Dynamometer results. W't'r per h. p. per hour.
Column No.	1	2	3	4	5	6	7
Braceville Coal: Westbound.							
180 lbs. {822 827	2 3	0.66	8.5	10.9	6.2	10.1	6.3
200 lbs. {822 827	4 5						
Eng. 822 on 180 lbs.	6						
Eng. 827 on 200 lbs.	7	20.5	25.5	29.1	31.2	22.9	25.7
Eng. 827 on 180 lbs.	8						
" " on 200 lbs.	9	20.0	18.5	10.7	23.5	14.0	20.7
All trips	10	10.6	17.0	20.0	18.7	16.5	16.0
East bound.							
180 lbs. {822 827	11 12	17.3	10.3	20.8	10.1	17.3	9.1
200 lbs. {822 827	13 14						
Eng. 822 on 180 lbs.	15						
Eng. 827 on 200 lbs.	16	15.4	13.2	21.2	17.1	17.5	11.8
Eng. 827 on 180 lbs.	17						
" " on 200 lbs.	18	2.3	4.9	3.2	6.3	0.0	6.0
All trips	19	16.3	11.8	21.0	13.6	17.4	12.1
All Trips—East and West	20	13.0	14.9	20.5	16.1	16.9	14.1
Pittsburgh Coal. Westbound.							
180 lbs. {822 827	21 22	4.9	7.1	1.1	3.4	1.1	3.3
200 lbs. {822 827	23 24	4.6	6.2	5.8	7.6	6.1	7.5
Eng. 822 on 180 lbs.	25						
Eng. 827 on 200 lbs.	26	17.6	11.8	14.1	5.7	11.9	5.1
Eng. 822 on 200 lbs.	27						
Eng. 827 on 180 lbs.	28	—10.2	1.0	—6.2	5.3	—5.5	5.8
Eng. 822 on 180 lbs.	29						
" " on 200 lbs.	30	13.7	6.0	7.8	—1.7	6.2	—3.4
Eng. 827 on 180 lbs.	31						
" " on 200 lbs.	32	13.4	5.0	12.9	2.3	10.8	1.8
All trips	33	4.7	6.7	3.6	5.5	3.5	5.4
Eastbound.							
110 lbs {822 827	34 35						
200 lbs. {822 827	36 37	16.1	16.4	10.0	9.6	9.3	9.3
Eng. 822 on 180 lbs.	38						
Eng. 827 on 200 lbs.	39	0.0	—5.2	10.0	4.7	9.1	4.3
Eng. 822 on 200 lbs	40						
Eng. 827 on 180 lbs.	41						
Eng. 822 on 180 lbs.	42						
" " on 200 lbs.	43	—19.2	—26.0	0.0	—7.3	0.0	—5.5
Eng. 827 on 180 lbs.	44						
" " on 200 lbs.	45						
All trips	46	8.7	6.1	10.0	7.2	9.2	6.9
All trips—East and West	47	3.2	3.1	6.8	6.1	6.5	6.0

TABLE III.

C., M. & ST. P. RY.—LOCOMOTIVE TESTS.—TABLE OF GENERAL AVERAGES.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
										Train results.		Dynamometer results.					
	Loaded cars.	Empty cars.	Weight of train, exclusive of engine.	Train ton miles, including engine.	Time on road.	Time running.	Time working steam.	Speed trip.	Speed, excluding stops.	Coal per ton-mile.	Water per ton-mile from and at 212 deg.	Total foot tons.	Foot tons per lb. of coal.	Foot tons per lb. of water at 212 deg.	Coal per horse power per hour.	Water per horse power per hour from and at 212 deg.	No. of trips.
Westbound, Braceville coal:																	
Eng. 822, B. P.—180 lbs.	18	9	448	50,144	6.45	3.95	3.40	15.1	23.5	.151	1.66	1,516,194	199.1	29.65	5.03	34.51	9
Eng. 827, B. P.—180 lbs.	15	8	430	46,225	6.29	3.44	2.80	15.6	26.7	.150	.97	1,362,694	220.8	31.49	4.52	32.36	4
Eng. 827, B. P.—200 lbs.	25	6	552	59,567	5.63	3.90	3.32	16.3	23.6	.120	.79	1,807,518	257.0	38.89	3 88	25.64	6
Eastbound, Braceville coal:																	
Eng. 822, B. P.—180 lbs.	26	3	748	77,602	5.94	4.22	3.19	16.8	22.3	.104	.68	1,689,989	209.4	32.26	4.74	30.80	8
Eng. 827, B. P.—180 lbs.	25	4	743	77,167	6.10	3.97	3.18	15.6	23.2	.086	.61	1,671,900	252-9	35.53	3.92	27.91	3
Eng. 827, B. P.—200 lbs.	26	8	798	82,158	5.49	3.99	2.99	16.8	23.1	.088	.59	1,830,063	253.7	37.79	3.91	26.25	6
Westbound, Pittsburgh coal:																	
Eng. 822, B. P.—180 lbs.	30	2	615	65,377	5.12	4.05	3.63	17.9	22.6	.102	.85	1,875,060	280.9	33 92	3.52	29.19	1
Eng. 822, B. P.—200 lbs.	24	3	521	56,830	5.61	4.10	3.50	16.3	22.3	.088	.80	1,527,224	302.8	33.32	3.30	29.96	3
Eng. 827, B. P.—180 lbs.	23	2	731	76,034	5.35	4.40	3.85	17.1	20.8	.097	.79	2,102,375	283.9	35.07	3.48	28.23	1
Eng. 827, B. P.—200 lbs.	29	2	583	67,551	5.28	3.54	3.06	18.0	25.9	.084	.75	1,647,338	320.5	35.87	3.10	27.70	3
Eastbound, Pittsburgh coal:																	
Eng. 822, B. P.—180 lbs.	25	3	719	74,984	4.85	3.75	2.92	18.9	24.4	.073	.58	1,502,094	273.0	34.28	3.63	28.88	1
Eng. 822, B. P.—200 lbs.	23	5	694	72,396	6.46	3.68	2.97	15.0	25.1	.087	.73	1,569,355	273.0	32.74	3.64	30.48	3
Eng. 827, B. P.—200 lbs.	26	7	754	78,169	6.62	3.79	2.91	13.8	23.8	.073	.61	1,813,392	300.3	35.93	3.30	27.64	4
First trips. Westbound, Braceville coal: Eng. 827, B. P.—180 lbs.	21	15	600	64,029	5.86	4.36	3.75	15.7	21.0	.131	.90	1,813,090	216.0	31 49	4.59	31.45	4
First trips. Eastbound, Braceville coal: Eng. 827, B. P.—180 lbs.	26	5	742	77,034	6.72	4.54	3 20	13.8	20.4	.098	.66	1,612,986	215.8	31.91	4.61	31.04	4

Placed it on the Jersey Central, and told them they might run it for two months, and if, at the expiration of that time, they had any objection to it they were at liberty to send it back. But at the expiration of the months they sent us an order for four more of the same kind. In regard to the economy that was reported from the C., M. & St. Paul with Pittsburgh coal, these engines are running on a railroad that is used to Western coal; they burn nothing but Western coal, yet they take the same engine and burn Pittsburgh coal, with the same grates, the same blast pipes, and they get a different result. You will notice also that there is a difference in the water economy of engines per ton of train hauled. I cannot see why there should be any difference.

Mr. A. J. PITKIN (Superintendent Schenectady Locomotive Works): I wish to call attention to the report sent to Mr. Gibbs by Mr. Small, giving equalization of work in the compound, believing, as we do, thoroughly in the two cylinder compound as being a case of the survival of the fittest. By reference to the tables you will find the distributien of power in the two-cylinder engine is quite variable. Since building this engine we have overcome that difficulty, and we now have an equalization of power that is very nearly perfect. At a full stroke we have a variation of 2.5 per cent.; at 17-in. cut-off a variation of only .17; at 13, 2.54; at 12, 1.24. In no case a variation of 3 per cent. So that we think this will silence all criticism about our engines wobbling by excessive pressure on one side. We went into the compound engine business first simply as an experiment, because we believed there was great economy to be obtained. We have sold three compound engines under solicitation. two of those going to the Michigan Central and one to the Pennsylvania for their limited train between Philadelphia and Pittsburgh. Out of 50 compounds these three are the only ones that we have sought to build, and the orders have come to us directly from the roads. In a number of instances where the question has been raised as to whether we would recommend the compound, we would say decidedly "No. Here are the results. You can take the compound, or the simple engine, as you please." Possibly we may be a little selfish, because we have built all the simple engines we could during the past year and possibly could not have built as many compounds. Regarding the different types of compounds, it is simply a case of the survival of the fittest. Simplicity is the main point to be sought for. We think the two-cylinder type is the simplest type that can possibly be obtained, and we get sufficient expansion to give good economical results, the economy varying from 15 to 30 per cent. according to the conditions of service. This is in comparison with engines of practically the same design, the others being simple engines.

Mr. JOSEPH LITHOGE (Superintendent and Agent Rhode Island Locomotive Works): We have built quite a number of compound locomotives. We are not advocating them strongly. If people want them we build them. We think we have a good type. We are making a saving of anywhere from 15 to 17 per cent. I do not think any of them are running with less than 15 per cent. saving. We have just received reports from the Brooklyn Elevated Railroad that is not in this report of Mr. Gibbs, where they have three of our engines, and are running those engines in competition with 12 others of exactly the same type—they have run 15,000 miles on that road, which means several months' service. In that report they claim a saving of 27 per cent. We also have built some four-cylinder engines of the Johnstone patent, and are building ten more of that pattern now, some of them for the Mexican Central and some for other roads, and they are showing very good economy. I believe Mr. D. L. Barnes has been conducting some tests with those engines, and I would like to hear from him as to how they are getting along.

Mr. D. L. BARNES: I have a telegram that my engineer of tests from Mexico has arrived in Chicago. He finds considerable saving with those engines—15 to 30 per cent., as near as he can estimate, the record not having been worked up. Mexican Central is a road that is well adapted for the compound locomotive. Coal ranges in price from $18 to $22 per ton. The saving per year for a compound engine, on the basis of the general results obtained, is about $15,000. On some sections of the road they use wood. The wood has to be carried over the mountains on the backs of mules, and it costs considerable by the time it reaches the road. I am sorry that I have not any data from those engines accurate enough to present here.

Mr. H. TANDY (Brooks Locomotive Works): We have been so busy building simple engines that we have not given the time and attention to compounding which we otherwise would have done, but for our own satisfaction we did build a compound engine of the two-cylinder type and placed it upon a road with the understanding that if the road desired they might purchase it at the expiration of six months, and, as they did so, I presume that is evidence that the engine gave satisfaction. This engine has been running in freight service since last September, and has quite recently been put in pretty heavy passenger service on trains that will average from 10 to 14 coaches. The engines, so I am informed, have been effecting a saving from 27 to 32 and 33 per cent. We are also building a compound engine of the four-cylinder type for our own satisfaction and amusement simply, and we are vain enough to think that we shall get quite as good a result from that as we did from the other one. I think that the question of compounding is so well understood by all master mechanics here that it is not necessary for me to advocate either one type or the other.

Mr. F. W. DEAN (Mechanical Engineer)—The Old Colony compound is a two-cylinder and has a cylinder ratio of 1.97 to 1; that is rather unusual; that is to say, the high pressure cylinder is rather large. Before the engine was tried I had some misgivings in regard to the proportion being a good one. The cylinders are 20 and 28, and I regretted for some time that they were not 19 and 28, but after trying the engine I think the sizes were wisely constructed, and if I were to build another I should certainly adopt just about that ratio. In regard to the matter of side oscillation of the two-cylinder type of compound, when the Old Colony compound first came out she had considerable side oscillation. That almost absolutely disappeared upon turning off the high pressure cylinder head a quarter of an inch, and giving more volume for compression. On the low pressure cylinder there is about 5.75 per cent. clearance. We made an experiment on a fast freight which runs about 25 miles an hour; the saving was about 31 per cent. The compound carried about 175 lbs. of steam, and the simple one upwards of 160 lbs. After the compound has been running six months in continuous work we began tests on express passenger work. I have not yet worked up a record, but the saving is fully 30 per cent. The water saving was abont 21 per cent.

The other compound engine that I have been connected with is on the Lehigh Valley. That engine has cylinders 20 and 30 by 24. It has not shown the same economy that the Old Colony engine has. It was put into a service that I did not contemplate. It never occurred to me that she was to push coal trains up a 96-ft. grade 12 miles long. I thought she was going to be used in a sort of general run on more level conditions. The cylinder ratio is just 2¼ to 2. I wish it was two to one. Then she could cut off much earlier, and, although she might have the same total expansion, it would be divided between the two cylinders. In pushing 30 cars up a hill she cuts off at 17 in., and of course that is altogether too late. She ought to be able to do that work at a cut-off not much later than 12 ins. I think the high pressure cylinder should be larger. You will then get your total expansion well divided between the two cylinders, thus producing the minimum condensation and the best results. The Lehigh Valley engine was tested in competition with a simple engine, built, I believe, by the Baldwin works. It has 150 sq. ft. of heating surface more than the compound, that is, about 9 per cent. more. Cutting off at 17 ins., the engine showed a saving of 16.4 per cent. in coal and 13 per cent. in water. The saving in another class of service has been 19.61 per cent. in coal and 23.99 per cent. in water.

In designing a compound locomotive it is desirable to have the cylinder surface as small as possible. The condensation in the cylinders is proportional, roughly, to the amount of cylinder surface and, by using the smallest number of cylinders that you can, you necessarily have the smallest amount of surface. Therefore, speaking in a general way, the engine which would have the least amount of surface would have the least amount of cylinder condensation. You should so design a two-cylinder compound engine that the expansion through the two cylinders will be continuous, and it can be shown mathematically that if the cut-off in a low pressure cylinder is at that point which is determined by the cylinder ratio, the expansion will be continuous through the two; that is to say, the low pressure cylinder will begin its expansion at the pressure at which the high pressure leaves off, and therefore the objections to the two-cylinder type that you cannot expand steam continuously disappears. I do not think the four-cylinder engine can be designed to do the same work as the two-cylinder engine, without having more cylinder surface and, of course, great condensation must follow. I think that is a great advantage of the two cylinder compound engine, let alone the question of simplicity.

A. E. MITCHELL (Erie R. R.): On Jan. 1 we bought from the Baldwin Locomotive Works five compound locomotives, weighing about 205,000 lbs. each, with cylinders equal to 24 × 28 in. These engines were bought for the Delaware Division, where we require three engines to get one train up the hill, the distance being eight and a quarter miles. We figured that the traction power of one of these engines was equal to that of two consolidation engines. Since they have been in service they have done the duty expected of them. We are burning a cheaper grade of coal than we were using on the consolidation engines. One fireman can easily fire the engine, maintaining 180 lbs. of steam. We have no cause of complaint of the surface we are getting from them. We cannot state anything about the repairs, as we have not had them long enough to decide what the repairs will amount to, though I do not think they are going to be very extensive.

There is one thing about compound engines that was not brought out yesterday which I think is going to be of large benefit, and that is, they prevent throwing fire. We are not throwing any fire from the stack, and, therefore, we are not liable to settle for fire claims to property along the line. That, I think, is going to be one of the main points with the compound, in addition to the saving of fuel. I was very much pleased with the committee's report.

Mr. JAMES MACBETH (Adirondack & St. Lawrence): —When I looked at the two cylinder compound I questioned whether it was going to be properly counterbalanced, and I had the drawbar between the engine and the tender three-eighths of an inch loose, because I wanted to see the oscillation. I rode on this engine at between 30 and 40 miles an hour, and I must say she was as straight a riding engine as I ever rode on. The reason for bringing up this point is that I cannot understand how they found that the two-cylinder did not ride as easy as the simple engine or the four-cylinder compound. I feel that when running through a dense wilderness our chances for fire are 30 to 40 per cent. less with

these engines. I have just finished a test on the Central Vermont Railroad with one of our compound engines and a simple Baldwin engine that showed a saving of 30 to 35 per cent., and the evaporation was 8⅛ to 5⅛. We made that experiment on a piece of road 30 miles long, 10 of it uphill, and a grade of 37 ft. to the mile. There may be a little question about repairs, but we have not observed so far that they are any more than on a simple engine.

MR. WILLIAM FORSYTH (Mechanical Engineer C., B. & Q.): The report is probably the best piece of work on locomotive tests that has ever been presented to this Association, and the Committee deserve a great deal of credit for their accurate and complete work. The report covers, of course, only one small phase of the subject—that is, a comparison of the Vauclain engine with a simple engine of a similar type. And that is still further narrowed down to a test of these engines in freight service. In the report is the statement of the number of variables entering into the road tests as being enormous. Now, that is so, and for that reason I think that the first thing to do in going into a very scientific locomotive test is to narrow down those variables as much as possible; and for this reason I would criticise to some extent the manner in which the committee have gone at this work in attempting to apply a long, scientific, accurate test to a freight train in regular service, and in attempting to get in that way average results. The results obtained by a test of that kind are shown by the report to be extremely variable, and, as the committee themselves admit, it is very difficult to draw any conclusions from it. In further considering the subject I hope the committee will confine themselves to a constant train on a regular schedule as near as possible, and, when they try to get fuel economy of average actual variable service, to simply measure the coal from trains in regular service extending over a long period. The economy given in the final conclusions is 7.6 per cent., and 16.9 and 14.1 per cent. Even 15 per cent., I should say, is a very low economy to be obtained from a compound engine in freight service; we ought to obtain a much higher economy. I think it has been found to be a common experience that the saving of a compound passenger engine is very much lower than compound freight engine. So that we should expect from a componud engine of this type in passenger service not more than 7 or 8 per cent.

As a result of more than a year's experience with a two-cylinder compound engine, we have found from the performance sheets an economy in freight service of 30 per cent. over our simple engine of the same type. We are just now testing this engine in passenger service. As a result of our experience with this engine, I would say that I would not hesitate at all, if I were to buy locomotives for myself with my own money, to buy compound locomotives for freight service. I believe that the principle is correct from an engineering point of view, and I have no doubt it will become in time the prevailing practice.

MR. J. N. BARR (C. M. & St. P.): There is one point in Mr. Forsyth's remarks that I want to object to, and that is where he says in making a test we want to narrow down the variables. It is the variables that make it questionable whether a compound is economical or not. We know that the compound is economical where the work is steady and uniform, as in marine and stationary work. I have gone over the experiments by Hirn in Germany, and I failed to find in those experiments that he feels satisfied that you can obtain an economy of ten per cent. by compounding over the best construction of simple engines, and that is only where you can compound engines and adapt them to the work to be performed and keep everything uniform. It may be that the compound engine is better able to meet the variable requirements of railroad service as a locomotive than the simple engine, and it may be decidedly the other way. We do not know. If the committee start with uniform conditions, I do not think they will give us any useful information. The conflict in the report arises from the variables. We have been doing too much in the way of eliminating the variables. We have done so, and made conclusions from the results that are not sustained in practice. I like Mr. Paxson's idea very much of taking a division and putting thereon engines, half of them compound and half of them simple, instructing the engineers as carefully as possible, trying to remove any prejudice, and then let them go, and let the results tell the story. The committee has had a great many of these points impressed on them during their tests this past year. I have been pretty close to this committee, and know what they have been doing. It was for that reason I moved that the committee be continued. They are beginning to see pretty clearly what informotion they want to ask of other railroad men of the country. That committee will need the co-operation and the close observation of all the other members of this association who are using compound engines, together with a close description of the circumstances under which they have been used and the results obtained.

MR. M. N. FORNEY: An ordinary engine burns about $2,500 worth of coal in a year; 15 per cent. of saving would amount to $275. To do that you have a locomotive that costs about $750 more than the simple engine. Deduct 10 per cent. of that additional cost for repairs, etc., and you have a saving of $300 in the course of a year where coal does not exceed $1.50 per ton. It is very easy to use up $300 on extra repairs. You will observe in these tests in burning Pittsburgh coal the compound shows considerably less saving than when buring Braceville coal. It would be a disadvantage to the compound if it is not able to burn all qualities of coal.

SECOND DAY'S SESSION.

A communication was read from the Delaware & Hudson Canal Co. and the Schenectady Locomotive Works, tendering a complimentary excursion to the members of the Association to visit the locomotive works.

CONTINUATION OF DISCUSSION OF COMPOUND LOCOMOTIVES.

MR. A. T. WOODS: The best illustrations of what the compound engine did are the tests at 200 lbs. and the simple engine at 180 lbs. with Braceville coal. There were eight or nine tests with each one. Those averages are: Coal per horse power per hour, 22.9 one way and 17.5 the other; and the water per horse power per hour, 25.7 and 14.8. These seem to me the most fair figures to use. The general averages for the different kinds of coal are, it seems to me, very valuable. Some of the saving is due to the higher pressure—how much it is difficult to say. I have made a hasty calculation on this. If the engine was cutting off about half stroke at 180 lbs., and the pressure was raised to 200 lbs., and the cut-off sufficiently early to take advantage of the raise in pressure, there may be a saving something like 10 per cent. If that is true, it will reduce the combined saving of coal and water shown in the above comparison to about 8 per cent. It is not possible to make an exact calculation of the loss by condensation in the two cases.

It seems to me that the horse power basis is the only one on which to make comparisons. The tables show there is a great difference, whether the ton mile or the horse power basis is used. As horse power takes into consideration the speed and the ton mile does not, it seems to me that it is the proper basis. I think Mr. Dean's figures do not include everything they should. In the two cylinder engine he may have less surface exposed to condensation, but as you also have a smaller ratio between the cylinder you also have less expansion; so that what you may loose on one you gain on the other. I do not think it is safe to say that the two cylinder compound with a large high-pressure cylinder is necessarily better.

MR. PULASKI LEEDS: A locomotive makes 3,600 miles per year. Coal costs, say, five or six cents per mile. At five cents per mile she will burn $1,800 worth of coal. If we make a saving of 10 per cent. it amounts to $180. Out of that take $100 for interest and renewals, leaving $80 for the replacement of the extra cost of engine. If our builders tell us that they would design a 30 in. piston and reciprocating parts in the same way that they would a 20 in., I should say that we should send abroad for designers. If they tell us they can overcome the extra moving weight without throwing extra wear on the engines they are telling what I do not believe.

MR. J. DAVIS BARNETT: The tables show that the imple engine with a higher pressure than the compound has a saving in the coal consumption, and the simple engine having 200 lbs. pressure has less economy than at 180 lbs. Do I properly understand that table to read that the simple engine having 200 lbs. pressure has a superior coal economy to the compound with low pressure, and yet the simple engine itself is not as economical when using 200 lbs.? This is a good report, and I feel sure we are all going to take it away with us and get to the very bottom of it, because very seldom has it been my lot to put my hand on such a large mass of information so accurately and conscientiously worked out.

MR. GEORGE GIBBS: I wish to say emphatically that I had no idea of the difficulties to be encountered in making a complete test of the compound engine. We attempted in the report to express our inability to cover the subject fully. Mr. Forsyth remarked that our first object was to eliminate variables. I take Mr. Barr's position. We want all the variables in there if we want to get the true economy. The only variable to eliminate is the variable manner of handling the engine. We therefore selected the most careful crews we could. The results do not represent the actual economy we would expect from the engine. I have no doubt, whatever, that we get better economy out of both engines than if put into every day service. We did not show what economy would result from everyday service. Mr. Forney stated that he wanted an engine able to burn all kinds of coal. The compound shows that it is such an engine. It gains 18 per cent. in a change from Braceville to Pittsburgh coal.

MR. F. D. CASANAVE: We have had little experience so far, having had only four or five compounds, which are scattered over a large territory, and we have very few figures to show the economy. From the somewhat imperfect trials that we have made of one compound locomotive we have found an economy of about five per cent. in fuel. There is no doubt that there is economy from compounding, and the economy will be greater in sections where the price of coal is greater also. But it seems to me that one of the essentials is to confine the compound to its most simple form; the matter of repairs and maintenance is one that must be looked to, to ascertain whether any saving in fuel is not absorbed in other ways. The compound locomotive is certainly in its infancy. If I were to take money out of my own pocket to equip a railroad, I hardly think I would go very extensively into the compounding. I would wait for a year or two, and until it had been clearly shown where the range of economy lies.

MR. L. B. PAXSON: We have upon the Reading Railroad some 27 compound engines. One type for working on our mountain grades pushing, built to be the equivalent of 22 × 28 consolidation engines. We have ten engines for fast freight service that were built to be the equivalents of 20 × 24. We have five engines that were built to be the equivalents of our 21 × 22. We have not attempted to make any scientific tests of those engines. We put them at work alongside other engines doing similar work, and we have been watching the coal used per month. Our engines on the mountains show a saving of coal between 25 and 30 per cent. The fast freight engines show a saving from 12 to 17 per cent. On the passenger runs we have only had one that has made a two months' run, and it is hardly fair to say what her saving is, although it is between 9 and 11 per cent. The engines have been running very nicely. They have given us no trouble, except the little trouble we had in breaking the men into using them.

MR. J. N. LAUDER: I agree with what Mr. Casanave has said, that until the railroads of this country know more about the compound locomotive than they do today we had better go slowly. I believe we are going to have a more economical type of engine. I do not believe that for the present we are going te get savings of 30 and 35 per cent. It we cannot get more than five per cent. saving I do not think it will pay any railroad to use compound locomotives. Because in the first place they must cost more, and the repairs are more. I believed one year ago that the compound locomotive must be specially designed for special work. What I mean is, a high speed engine must be specially designed for high speed and would not be a serviceable or economical engine on any other kind of traffic. My experience in the past year has modified that opinion. And to-day I am prepared to say that a compound locomotive can be designed that will have as wide a range of service as the simple engine. I propose to build more compounds with 6½ ft. wheel and 26-in. stroke. In a compound locomotive the quality of the exhaust is so different that it needs special appliances to bring out the benefits of the exhaust. Owing to the light pressure of the exhaust it spreads very quickly after leaving the nozzle and makes a whirl of the gases in the smokebox that retards the draught and we had to use a smaller exhaust tip. By making the bottom of the smokestack bell-mouthed, the steam and gas goes out, giving a clean, smooth exhaust.

MR. S. M. VAUCLAIN: Mr. Lauder has said the compound requires additional repairs. I dispute that. The repairs to the cylinders of the compound will perhaps be slightly greater, especially in the two-cylinder type, where you have the intercepting valve to look after. The pistons are larger also. There is no doubt that in that type and in the one I represent additional repairs will be necessary in the cylinders. But a compound does not have to be forced as a plain one does and the life of the boiler is increased and we have less repairs on a compound locomotive boiler, which will much more than offset the additional repairs required on the cylinders and pistons. The compound is adapted for any service, suburban, fast or slow freight or passenger. We have twenty compounds running on the "Alley" elevated road in Chicago. They undergo harder service than any passenger engine from Philadelphia to New York. As a proof of that our compounds are equally applicable for all service, examine these elevated engines. That the compound must have larger drivers is not true, but better results can be had with larger wheels, but the same is not true with the simple engine. That has been clearly proven by engines we have built which are running on several roads, and the Schenectady people can bear this out, I think. Mr. Lauder says that before a railroad should start in on compounds they must get results. How are people to get results if the compounds are not used? The Philadelphia & Reading have ordered enough to judge. The Schenectady works are building a lot of compounds for a road on the Pacific slope, and that road is going at the matter in the same sensible way that the P. & R. has. Any railroad can afford to buy 10, 15 or 20 compounds, providing they have a large system. I will agree that a compound can start equally as well as a plain engine. It can even start quicker, because it hasn't as much steam to get rid of as a plain engine. Our compound engines are running with the same blast apparatus as the plain. I think the Schenectady people have had the same experience. We do not need smaller tips or a special smokebox arrangement.

MR. A. DOLBEER: Being on a road where fuel costs only $1.25 a ton, I am not an advocate of compound engines. We bought two compounds from Baldwin of the Vauclain type last September. At first the compounds showed a saving of 16 per cent. in fuel upon a car mileage basis—not upon a tonnage basis. In December it was 12 per cent. In January 32 per cent. In February the weather got bad, and it was 6 per cent. In March the simple engines had made a saving of 7 per cent. over the compound engines, because the engineer was not an advocate of the compound locomotive. But we have conclusively proved that the Vauclain compound engine is superior to the simple engine in an emergency where you need added power to get you out of a hole.

Mr. C. E. SMART: In justice to the Michigan Central and to myself I will say that the reason why the Michigan Central, having two compounds, did not continue to build or buy them is because we found that in order to get the best results from the compound engine it was necessary that the engine should be worked to her maximum capacity. I believe that is the experience of those who have tested the compound engines. On the Michigan Central the load one way is light, the other way heavy. We do not wish to put compound engines into the hands of inexperienced men and trust to the results during the World's Fair year. I have never claimed more than 12 to 15 per cent. of saving in favor of the compound even under the most favorable conditions. A short time ago we made a test and the figures showed a saving of 15 per cent. There was a saving in the water of only 7.4 per cent. That test extended over a period of some 4 or 5 days and covered a mileage of 1892 miles, drawing 45 cars. In our simple engin s we use 4½ in. exhaust in some cases 4¾. In the compound we have no difficulty in using 5¼ in. In regard to the intercepting valve it has certainly been doing good work with practically no repairs.

Mr. R. H. SOULE: I think that the Norfolk & Western Railroad, during the last six weeks, has really had a very exceptional experience in this matter of compound locomotives. In the early spring the road found it necessary to add to their locomotive equipment. In the additional equipment there was to be 15 passenger engines. The different builders were invited to compete. The Baldwin was awarded the contract. It was agreed we should take five compounds at once for trial and the builders rushed them through. We were instructed to give our opinion in one month after these engines were put into service as to whether the remaining 10 should be simple or compound. We distributed these engines on the two divisions of the railroad so as to get results from two independent sources. They were watched by careful men. We found a saving of 20 per cent. in fuel and 10 per cent. in water. We recommend that the additional 10 engines should be compound. We had no choice, but took the Baldwin compound simply because it was compound and because we had demonstrated it was an advantage to the railroad company. In advancing the pressure in the boilers you reach the limit of economy in the simple before you do in the compound. My impression is that the most economical point of cut-off in the simple engine is between $\frac{3}{10}$ and $\frac{4}{10}$ of the stroke. The only possible advantage in increasing the working pressure on a simple engine will be the possibility of cutting off earlier. The report leads us safely to the conclusion that we have about reached the limit of economy in the working pressure of a simple engine. If the officers, train despatchers, etc., find they can get more work out of a compound, there is going to be a large battalion in favor of the compound that it will be difficult to oppose. If the compound will do more work with the same fuel then it will also move over the road faster, because the steam will go farther. I anticipate that when the transportation department wakes up they will enlist themselves on the side of the compound engine.

Mr. I. H. SETCHEL: The Pittsburgh Locomotive Works have no compound locomotives in service, but expect to. We are constructing a compound locomotive, and we expect, by giving an increased heating surface, grate surface, a very much larger boiler, and the other advantages that we can get over the plain engine, to show a saving equal to any of our competitors.

Mr. D. L. BARNES: The tests given in the report represent 60 tests made in the most accurate manner that any tests have ever been made, and if we cannot draw a conclusion from these then there is little use of all kinds of fine apparatus in testing locomotives. I think if any one will examine carefully all the conditions that are so well given in this report that he will be able to deduce useful conclusions. If not, the only thing to do is to have a long time test under running conditions. The statement about a saving on the Adirondack & St. Lawrence I would like to call attention to, as it emphasizes some of the analyses I have made of other tests. There was a saving of 30 per cent. in coal per ton per ton mile. That is the final saving of the engine, but in the firebox there was a saving of 45 per cent. Now, the other 15 per cent. must have been lost by the compound system if logical reasoning can be applied to the results given us. The same paradox can be found from a great many tests that have been published. If you subtract from the saving per ton mile the saving in the firebox you get a negative result, which would indicate that if you should improve the combustion in the simple engine it would beat the compound engine. I believe there is something wrong with such results. Another speaker has claimed 30 per cent. economy for the compound, but in that case he had 25 or 30 lbs. greater boiler pressure on the compound and did not mention it. I do not think that it is fair to the simple engine. So far as the theoretical saving of a compound engine is concerned it is not due as stated here to the lesser amount of cooling surface, but to the decreased range of the temperature in the cylinders. Most compound engines have greater cooling surfaces. The surfaces of the ports are very large in proportion to the capacity. About the oscillation of the compound, it seems to me it is all dependent upon the method of balancing. On the elevated road in Chicago we have 20 engines running, and they run as steady as any simple engine could up to a speed of 40 miles per hour. If it is true that these tests in the report are the result from comparing the simple engine with a sufficiently large cylinder with a compound engine with too small cylinders, then we should be careful about drawing conclusions. Perhaps the compound engine would have been more economical at 180 pounds boiler pressure if it had cylinders of the proper size.

The committee on the Present Status of the M. C. B. Automatic Coupler reported that no action was needed at present except to approve of what had been done by the Master Car Builders' Association. This report was received and the actions taken by the M. C. B. Association up to this time were indorsed.

TESTS OF STEEL AND IRON.

A number of tests were made to throw some light on the matter of what is known as the critical temperature of steel, it being generally understood that at a blue heat, or at a temperature of about 600 degrees, steel is extremely liable to crack in bending. The experiments of your Committee demonstrated that this is a fact, and that steel that will bend when cold, or at a red heat, is extremely liable to crack when bent at a temperature varying between 500 or 800 degrees. The result of these tests are given in table No. I, attached to this report. In this table the difference makes of steel are designated by letters from A to I. In making these tests, the steel was first bent to a right angle, or 90 degrees, and then hammered down until it began to give decided signs of cracking; if no cracks appeared, it was hammered down so that the sheet closed on itself, which is designated by an angle of 180 degrees. In a number of cases cracks did not begin to appear until just about the time that the sheet was bent to 180 degrees.

The lot marked "A" was taken from an old firebox which cracked badly, and was removed after ten months' service. It is of the same length as the lot marked "F." It will be seen from the tests that steel which had been in a firebox, but had cracked after making a short service, gave, in some cases, very good results in the bending tests at 600 degrees, and also at 800 degrees, and cold. It will also be observed in looking over these tests, that while some steel cracked at 800 degrees, others did not, and also the same steel in some cases cracks at 800 degrees, while the second test, made at the same temperature, does not show any cracks.

Your Committee was inclined to be of the opinion that, if steel tested at the blue heat stood the bending test without cracking, there were strong probabilities of its being a good material for firebox purposes. However, an observation of the tests, as shown in the table, indicates that this position cannot be maintained. This is further shown by the fact that old firebox steel, marked in the test as "A," stood portions of this test better than some new steel of the same make, and also better than some new steel of other makes.

The conclusion of your Committee, from tests made, is, that steel which stands a bending test at a blue heat does not necessarily give material which can be depended on not to crack in service.

It was suggested that iron plates, on account of the tradition that they were less liable to crack in the firebox, would resist fracture at a blue heat better than steel. Your Committee accordingly made a number of experiments of the same kind with the samples of the best iron boiler-plate made in this country and England, the result being that at a blue heat the tendency of the iron plate to crack was decidedly greater than is the case with steel. This, in the opinion of your Committee, corroborates their position that the bending test at a blue heat is not a criterion on which to base an opinion of the suitability of material for firebox purposes.

The tests of steel at a blue heat, as referred to above, do not really introduce any new information so far as the fact of the liability of steel or iron to crack at a blue heat is concerned, but the tests, as shown, would seem to imply quite clearly that material which will stand this test is not necessarily good material, and it also illustrates the importance, in handling any material of this kind, of working it either cold or at a red heat.

Etching.—A number of tests were made by etching new and old steel, the etching mixture being diluted with sulphuric acid. . . . The most interesting results were observed in etching steel which had been in service in fireboxes. In several samples of steel three-eighths of an inch thick there was a decided difference shown in the structure of the middle portion of the steel as compared with the two outside edges, there being a zone through the centre of the piece about an eighth of an inch wide which the etching material attacked most actively. The outer eighth of an inch on either side showed but little more effect than new steel, while the inner eighth of an inch was spongy and appeared to be an entirely different material.

A number of tests were made of old sheets varying in service from 80,000 to 600,000 miles, and some of the pieces which had only made 80,000 miles showed more of a disorganization of the interior of the sheet than the samples which had made 600,000 miles. Unfortunately, it was not possible to obtain etchings of these sheets when they went into service, but your Committee is of the opinion that this phenomenon would not have been observed in the new sheets. Further tests should be made of new sheets, and of the same sheets after they have been in service, to establish this point.

The spongy interior of several of these pieces was carefully removed by a narrow tool, leaving the outside and inside of the sheets about one-eighth of an inch in thickness, intact. Of these two pieces the one next the fire sprung inward toward the fire about $\frac{1}{10}$ of an inch in a length of 8 in., forming an arc of a circle, the one next the water remaining almost perfectly straight. This phenomenon, perhaps, indicates a permanent expansion of the sheet on the next side the fire. Your committee was of the opinion that in cutting out the central portion of the sheet it might have been strained by the action of the tool, and to verify this point a piece of new steel was cut and split in the same manner; this showed no camber whatever.

Annealing.—It has been claimed that annealing a sheet would restore it to its original condition; with this object in view your Committee took a piece of the same sheet, carefully annealed it by heating to a red heat, then placing it between two pine boards and allowing it to remain until cold. The centre was then cut out as in the other cases, and the result was the same as with the piece not annealed. This apparently clearly demonstrates the fact that annealing an old sheet of steel does not restore it to its original condition.

If there is a similar set or permanent expansion in the ends of the stay-bolts next the fire, it may be that it somewhat accounts for the cracks radiating from the staybolts which are so frequently found in steel sheets.

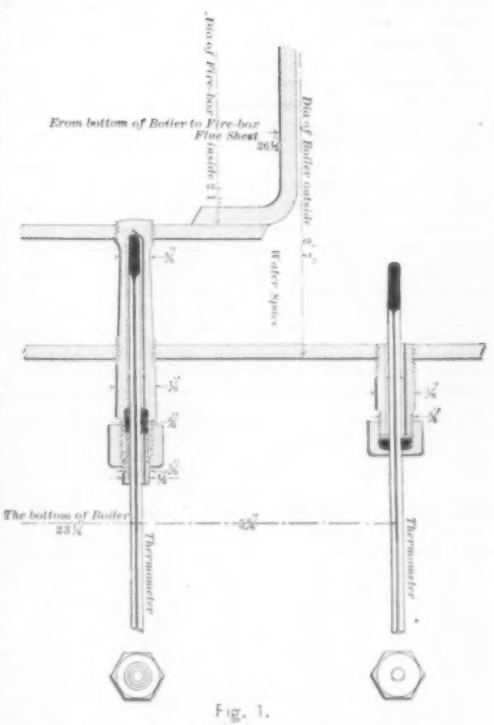


Fig. 1.

The facts as stated above in brief are as follows:

1. There is apparently a disintegrating action taking place in the centre of the sheet.

2. The side next to the firebox seems to be permanently expanded, giving it a camber when set free by being sliced off from the rest of the sheet.

3. Annealing after service does not remove this phenomenon.

4. The above phenomenon may be a strong argument in favor of thin sheets.

Steel Tubes vs. Iron Tubes.—The information as to the relative merits of steel and iron for boiler tubes has excited considerable discussion, but your Committee has very little definite information to present. We are, however, advised that in the case of a large number of steel tubes the results, so far as wear is concerned, have been unfavorable. The following definite experiment, however, has been made: An engine was equipped with 114 iron tubes and 113 steel tubes on Dec. 20, 1890. The iron tubes were placed on one side of the centre and the steel tubes on the other side of the centre of the boiler, the flues being divided by a vertical line through the centre of the flue-sheet. On March 9, 1892, the flues were all removed. Seventeen of the iron tubes were condemned on account of pitting and corrosion, while 64 of the steel tubes were condemned for the same defect. This would indicate that steel tubes are more affected by corrosion than iron ones. Further experiments and information in this line, however, is desirable in order to fully settle this question.

Temperature of Firebox Sheets.—In order to determine the temperature of a sheet in a firebox when the engine is being fired up, an experiment was made with two thermometers located as shown by the accompanying drawing, fig. 1. One thermometer was placed in the water space and the other in a drilled staybolt with the bulb at the inner sheet, as shown. The boiler was a stationary vertical one, and was fired with oil and rosin wood. The maximum difference in temperature between the water and firebox sheet, as shown by the thermometers, was about 25 degrees.

Staybolts.—In the matter of staybolts your Committee has very little to present; an endeavor was made to devise an apparatus that would represent a staybolt

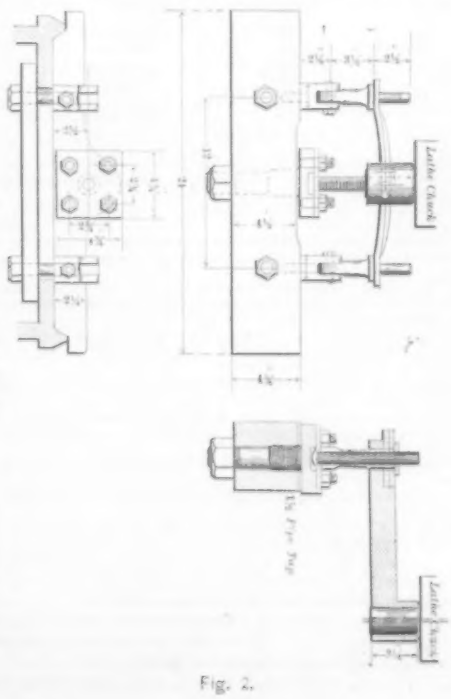


Fig. 2.

riveted into the sheet, to be subjected to vibrations in order to determine which material would resist the greatest amount of vibration. The apparatus in which the test was made is shown in fig. 2. This arrangement gives in vibration a full motion of three thirty-seconds of an inch at the end of the staybolt, and at the same time allows a stress in the direction of the length of the staybolt somewhat similar to that which occurs in boilers, the strain put on the staybolt being equivalent to a pressure in the boiler of 150 lbs. per square inch. A test was made in this way of four pieces of mild machinery steel; the average number of vibrations before breakage was 21,539, the pieces standing respectively 7,950, 96,000, 14,168 and 54,358 vibrations before breaking.

Eleven samples of iron were tested in the same way, the average number of vibrations before breaking being 6,568, the lowest being 3,120, the greatest 12,480. The result of these tests would indicate that steel is a better material for staybolts than iron; at the same time the experience of a number of members of your Committee with steel staybolts has been seriously against them. They failed in service, and deductions drawn from the test, as made, are entirely misleading. Your Committee does not feel that in this they had added anything to the subject of a proper method of determining the suitability of any special material for stay bolts.

The investigation, as described above, is not sufficient to enable your committee to offer any specific directions

TABLE NO. I.

Make.	Number of Piece.	Temperature. Degrees.	Thickness of Plate. Inches.	Results.	Angle. Degrees.
A	1	800	3/8	No cracks.	180
	2	800	5/8	Cracked.	170
	3	700	1/2	"	180
	4	600	3/4	Broke off.	90
	5	600	5/8	No cracks.	180
	6	600	5/8	"	180
	7	600	5/8	Cracked.	170
	8	500	5/8	"	180
	9	500	5/8	"	180
	10	400	5/8	"	180
	11	cold	3/4	No cracks.	180
	12	cold	7/8	"	180
B	1	800	1/2	Cracked.	180
	2	600	1/2	"	160
	3	600	3/4	"	174
	4	600	1/2	"	137
	5	600	3/4	"	170
	6	500	1/2	"	180
	7	500	3/4	"	175
	8	500	3/4	"	180
	9	500	1/2	"	172
	10	500	1/2	"	170
C	1	800	3/4	Broke off.	90
	2	800	3/4	Cracked.	180
	3	700	3/4	Broke off.	90
	4	600	3/4	Cracked.	175
	5	600	3/4	Broke off.	90
	6	500	3/4	Cracked.	132
	7	500	3/4	"	155
	8	400	3/4	"	170
D	1	800	1/2	No cracks.	180
	2	600	1/2	Cracked.	170
	3	600	1/2	"	180
	4	600	1/2	No cracks.	180
	5	500	1/2	Cracked.	180
	6	400	1/2	"	175
E	1	800	1/4	No cracks.	180
	2	600	1/4	Cracked.	180
	3	600	1/4	No cracks.	180
	4	600	1/4	Cracked.	180
	5	600	1/4	No cracks.	180
	6	600	1/4	"	180
	7	500	1/4	"	180
	8	400	1/4	"	180
F	1	800	1/4	No cracks.	180
	2	600	1/4	Cracked.	154
	3	600	1/2	"	170
	4	500	1/2	"	180
	5	500	1/2	"	175
	6	500	1/2	.....	...
G	1	800	1/8	Cracked.	180
	2	600	1/8	No cracks.	180
	3	500	1/8	Cracked.	180
	4	500	1/8	No cracks.	180
H	1	800	1/4	No cracks.	180
	2	700	3/4	Cracked.	180
	3	650	3/4	"	165
	4	650	3/4	No cracks.	180
	5	600	3/4	Cracked.	180
	6	600	3/4	"	180
	7	600	3/4	No cracks.	180
	8	400	3/4	"	180
I	1	800	3/4	No cracks.	180
	2	700	1/2	Cracked.	180
	3	600	3/4	"	90
	4	600	3/4	No cracks.	180
	5	600	1/2	Cracked.	146
	6	600	1/2	No cracks.	180
	7	400	1/2	Cracked.	170

for drawing up specifications for iron and steel for firebox purposes, and they therefore have in this particular no definite recommendations to make.

The results of the investigations so far may be summarized as follows:

1. Steel or iron should not be worked at a temperature between a normal temperature and a perceptible red heat.

2. So-called "blue heat" makes steels and irons more brittle, but some are apparently less affected by the "blue heat" than others.

3. The test of steel or iron at a "blue heat" is not a criterion by which to judge of the action of the same in a firebox.

4. Iron at a blue heat is more seriously affected than steel.

5. There is apparently a mechanical disintegration going on in plates exposed to the action of fire, water and scale in a firebox.

6. Steel tubes do not seem to be as durable as iron tubes.

Committee recommends that this subject be continued for another year at least.

WILLIAM SMITH, J. N. BARR, A. W. QUACKENBUSH, P. H. PECK, D. L. BARNES,

Committee.

The report was received and accepted, and the committee continued for another year.

Mr. WILLIAM SMITH: I would like to ask the steel manufacturers here what value they place upon a chemical analysis in the manufacture of firebox steel?

Mr. WELLMAN (Wellman Iron & Steel Co.): From a manufacturer's standpoint I consider the chemical analysis of steel of the utmost value. We could not pretend to run our works without daily and constant analysis, both of the raw material that we use and the finished product; but I would not want to depend entirely upon chemical analysis as showing me whether steel is all right. We have got to have a combination of the chemical and physical analysis, and even that does not tell the whole story.

Mr. J. N. BARR: If a steel maker is making steel from material obtained from certain ore in a certain locality, and has been manufacturing steel right along for years, and has demonstrated that he is turning out a first-class quality of steel, can he then call in a chemist and analize a deposit of ores from some other section and be satisfied that he is going to give his customers as good an article of steel as he has done previously?

Dr. HUSTON (Lukens Steel Co.): We cannot tell entirely by chemical analysis what results we are going to get. We must have a certain chemical analysis to produce a certain article. But that analysis will not always produce that article.

Mr. WELLMAN: I should say that an analysis was only an indication. If from our experience the analysis showed that the ore would make good steel, I should be inclined to try a small batch of it. I am not a chemist, but I think I could tell without fail from analysis of an ore, if the chemist would give us a complete analysis; but they do not do that; they do not tell us more than half the story.

Mr. D. L. BARNES: As a member of the Committee I would like to say a little about this report. Our Chairman has said that he believed an etching will show more about steel than a chemical analysis. I believe he is right, if he would go further and say that an etching will show more about the mechanical structure of the steel—that is, whether it is laminations or cracks. But so far as showing whether the steel is good for a firebox or a boiler steel, or a tank plate, I do not see how it can be done from an etching because an etching of one good solid sheet of stell will look almost exactly like an etching from another good solid sheet. Referring to a report and the sample marked "A," the result there shown is exactly what would occur if there was a very bad lamination for the plate. I heard of a case the other day where a brick had accidentally gotten into an ingot and they made a boiler plate of it, and when they put it in the firebox it was found to be laminated. The edge of it looked not much different from the picture "A". I would hesitate myself to say that the etching of a firebox plate shows that the plate deteriorates in the centre, or anywhere else after service. As far as the chemical analysis of steel is concerned, the chemists give us the exact amount of the different elements in the steel, and they do not say, except in the case of carbon, in what way these elements are combined. For instance, they refer to "combined" and "graphitic carbon." One is a chemical combination with the iron and the other is nearly a mechanical mixture. But in the case of phosphorus and manganese they do not say whether it is one phosphate of iron or another. It is well known that one phosphate of iron may differ from another phosphate of iron, as much as iron differs from steel. The question of lamination has been avoided by the committee, yet I do not see why it is not a very important one. We avoided it, I suppose, because we could not say anything about it that was of any great value. One laminated sheet last year cost a locomotive builder $2,000. I suppose the steel makers replaced the sheet for $15, a very small percentage of the total cost. In making specifications for steel sheets for fireboxes some directions should be given to discover whether the sheets are laminated or not. Etching the edge will not show what is in the middle of the sheet, and one cannot bend a sheet to see the cracks and then use it afterward. Perhaps the only way to do is to hold the makers of the steel responsible. Steel has in one case at least been guaranteed for two years against lamination, with the understanding that the steel maker should pay the cost of replacing bad sheets. If there is a lamination in a firebox plate at first it will always be there; if there is none when it is made, then there will never be any. In regard to the test of stay bolts, from subsequent examination made since this report, I am of the opinion that the reason why there was such a wide difference in the results from vibration tests lies in the way the stay bolts were fitted into the sheet. If you take a hard steel sheet and tap a thread into it with a sharp tap, and then screw into that a soft iron stay bolt, which is a little larger than the hole, that staybolt will be ruined because the hard sheet will cut into the staybolt and start a crack. A loose staybolt will generally last longer than a tight one, because it has less bedding strain. So I believe if these tests were repeated, and care was taken to have the hole in the sheet cut smooth, and the thread on the staybolt round at the bottom, with a corresponding rounding on the bottom of the tap for the sheet, I think the results would be more nearly uniform. I would say that one of the testing machine makers has taken this matter up now, and is going to make a large series of tests to determine how to distinguish a good from a bad staybolt material.

Mr. FORSYTH: I agree with the conclusions of the committee that steel tubes do not seem to be as durable as iron tubes. Steel blooms can be made cheaper than iron. A steel tube at the same price as an iron tube I do not believe is as good. In addition to the trouble from corrosion with the steel tube, we have found trouble with the welding. It is very difficult to weld a steel tube and make it stand in locomotive service.

Mr. GIBBS: I think the committee should investigate the physical properties as shown by the two very characteristics of fracture of which are found in the commercial brands of boiler steel. The two fractures are a granular and a silky one. I can often tell by looking at the fracture where the steel comes from. The analysis of those brands are in all cases equally good from a chemical standpoint, so far as we know. I would indorse what Mr. Wellman says about chemical analysis. We have been keeping a very elaborate record of our firebox sheets, and hope in two or three years to have some useful results.

Mr. CHARLES BLACKWELL: The report shows that it is unsafe to base conclusions on one test from one piece of steel. There should be several experiments. In some cases I have tried at the same temperatures one piece would break, and another piece would not break. I have here two samples, each of which we tried to raise to exactly the same temperature. One broke almost in two. In the other the sides were almost brought together, and there was hardly a crack to be seen. They were cut off the same sheet. This shows that a very little difference in temperature and conditions will give a very different result. When coupons from steel plates are tested for tensile strength, elongation and reduction of area, it is absolutely necessary that the coupons be carefully handled, and not subjected to improper treatment. They should be seperated from the sheets by means of long bladed, sharp shears, so as to prevent distortion. Distortion results in a change in tensile strength and percentage of elongation.

Should the compound be bent so as to require straightening flatwise it should be done by means of a flatter applied to its side and then little or no damage will ensue, provided light blows only are used. But if the coupon is bent edgeways, or curled, from the use of shears with too short a knife, it is imperative that the piece be not struck upon its edge. It should be trued up upon a planer or equivalent tool, otherwise considerable deviation from correct results will follow when pulled in a testing machine. The effect of moderate punishment of test pieces seems to be an increased tensile strength, a reduction in percentage of elongation and a diminution of reduction in area. The error is sufficient sometimes to condemn a good sheet, for excess of tensile strength and deficiency of percentage elongation and reduction of area, and may cause serious delay to work in the shop before the cause is discovered and satisfactorily explained to the consumer.

Dr. HUSTON: Steel coupons should never be cut off with shears. It should be done by a milling machine or with a planer.

Mr. J. N. BARR: I would like to ask a practical question. If the cracks in the sheets shown here results from piping, is there any method of inspection that we can establish that will keep us free from piped steel? We do not want it.

Dr. HUSTON: If you cut off a coupon you would probably find the piping all the way through.

Mr. J. N. LAUDER: To a layman like myself it seems that if 20 years ago the manufacturers of steel plate could make steel plate that would give us 20 years of service, they ought to be doing the same to-day. Possibly some of the fault lies with us. The average purchasing agent wants the steel that he can buy at the lowest price.

Dr. HUSTON: As Mr. Lauder has made some reflections on the manufacturers, I would like to make some reflections on the consumer. A low priced article is not the cheapest. I would remind him at the same that they tie us down to a set of tests, and we have got to meet them. We submit the steel to those physical tests, and I do not think those tests are the best.

Mr. J. S. MCCRUM: I agree that the question of the price of steel is considerable of a desideratum. I would inquire of some of the steel makers whether they think they could make a better steel?

Mr. JACKMAN: I can say for Hussey, Howe & Co., of Pittsburgh, that we were, 20 years ago, making firebox steel, but the price of that material has gone down of late years to such a point that we could not make enough profit to induce us to stay in that line. If the railroads of this country would pay what we consider a fair price, the successors of that firm would go back into the business.

Mr. WELLMAN: I have been making firebox steel for some 18 years. I have been trying to make the very best article I could possibly make, and to-day I am still doing the same. The price does not have any influence upon the manufacture at all, and I believe we are making a better steel to-day than I have ever made in the last 18 years, and when I cannot make the best firebox plate that can be made, then I will quit the business.

REPORT ON UNIFORM LOCOMOTIVES PERFORMANCE SHEETS.

First. We would recommend that all passenger and freight mileage be based on actual miles run, and five per cent. to be added to all freight mileage; that all engines in construction or snow-plow service be allowed at the rate of 10 miles per hour; all engines in switching service be allowed at the rate of eight miles per hour, no

percentage to be added to this class of mileage. All other runs of less than 100 miles freight or passenger, actual miles to be allowed, regardless of what engineers and firemen may be paid for such service. No extra mileage should be allowed going to and from the roundhouse. When an engine is assigned to more than one class of service, the mileage should be computed, so as to show each class of service.

Second—In the distribution of fuel, one cord of wood should be rated as one ton of coal, and all expense in connection with the handling of fuel, either wood or coal, to be included in the cost of same; all coal to be rated at 2,000 lbs. per ton.

Third. In the distribution of illuminating oils, only such oils are used in the head-lamps and lamps and torches belonging to engines should be shown on the performance sheet.

In the distribution of lubricating oils all oils used in lubricating engine, including that used in packing driving boxes, tender and engine trucks, while engine is undergoing general repairs, should be charged to repairs. All lubricating oils used on engine after engine goes into service, to be charged on cost and performance sheets as lubricating oil against engine.

Fourth. In showing the miles run to one pint of oil, the engine, valve and illuminating oil should be separated, showing the miles run to one pint of each, and a separate column be made on engine's statement, giving the total average for all kinds of oil.

All waste used by engineers and firemen, and by wipers for wiping engines, should be shown on performance sheet, and the miles run to one pound of waste given. Waste used on engines while undergoing repair should be charged to repairs.

Fifth. In the apportionment of the expense of labor for repairs of engines, we believe no labor should be charged for repairs other than performed by mechanics, helpers, and those actually working on repairs; laborers, sweepers, sanding and turning table, cleaning roundhouse, and other outside work in and about roundhouse, should not be charged to repairs, but should be charged to locomotive service.

All undistributed labor, such as superintendence, clerks, etc., should be prorated over general shop expense. Cost of engine repairs, caused by accident due to other than engine failures, to be not shown on performance sheet, but such expense should be kept separately, and charged to the department responsible for the accident.

Sixth. All new engines purchased or built to take the place of those worn out should not be charged to repairs of locomotives. All general repairs of engines, including overhauling, etc., except the above mentioned, to be charged to repairs, except the application or new devices, such as air-brake equipment, extension front end, steam-heating appliances, train signal or smoke consumer. We believe the application of these new devices should be charged to new equipment or betterment. In the charges for materials used on engines, including files, chisels, other small tools, and the engine's equipment, should be charged to repairs of engines. We would recommend the preparation each month of a performance sheet in detail for each division of the road, the same to contain the following information:

Engine No.	Names of Engineers.	Names of Firemen.	MILEAGE.				
			Pass'g'r.	Freight	C'nstr.	Switch.	Tot'l

Tons of Coal.	Cords of Wood.	Total Tons.	Pints of Engine Oil.	Pints of Valve Oil.	Total Lubricating Oil.	Pints Illuminating Oil.	Total all kinds of Oil.	Total Cost for Repairs.

Cost of Coal.	Cost of Wood.	Cost of Oil and Waste.	Wages of Engineers and Firemen.	Wages of Hostlers, Wipers and Miscellaneous Labor.	Cost of Material for Repairs.	Cost of Labor for Repairs.	Total Cost for Repairs.

COST PER MILE RUN.

Fuel.	Oil and Waste.	Engineers and Firemen.	Hostlers, Wipers, etc.	Repairs. Labor.	Repairs. Material.	Total.

MILES RUN TO							Average Number of Loaded Cars per Train.	Average Pounds Coal Consumed per Car per Mile.
Ton Coal.	Pint Engine Oil.	Pint Valve Oil.	Pint Lubricating Oil.	Pint Illuminating Oil.	Pint all Oil.	Pounds of Waste.		

To place the rating of empty cars on a uniform basis, your Committee would recommend the following:

In figuring loads, all box, stock, refrigerator and furniture cars, 30 ft. long or over, three empties to be considered equal to two loads; gondola and flat cars, two empties to be considered equal to one load.

GEO. F. WILSON, J. S. MCCRUM, JOHN PLAYER, JAS. MCNAUGHTON, JNO. A. HILL, *Committee.*

This report was referred back to the committee with instructions to cut out the clause recommending that the cost of engine repairs caused by accident be omitted from the performance sheet, and with further instructions to prepare an interchange sheet showing proper recapitulation of the information contained in the original.

THIRD DAY.

THE REPORT OF COMMITTEE ON STANDARD BOLTS AND NUTS.

This committee made an interesting report, which is too long to use here. Copies can be obtained by addressing the secretary of the association. The following are the conclusions in the report: The duties of your committee, as before mentioned, being of so general a character, no very particular recommendations can be made, and we will therefore close by

First, Commending and emphasizing the United States standard, and urge upon all a rigid adherence to same.

Second, That it is practicable to maintain the United States standard with the methods and gauges available.

Third, The committee recommends the adoption by the association of the United States standard for nuts, based on rough size, regardless of finished nuts.

WM. SWANSTON, WM. GARSTANG, T. W. GENTRY, W. LAVERY, A. DOLBEER, L. R. POMEROY, *Committee.*

On motion of Mr. M. N. Forney the report and recommendations were amended and adopted as follows:

First. That this association commends and emphasizes the United States standard and urges upon all a rigid adherence to the same, and deprecates the use of more than one set of dimensions for each size of bolt and nut, and urges all railroad officers to discontinue the use of screws which are not of standard sizes.

Second. That it is practicable to maintain the United States standard with the method and gauges available.

Third. The Committee recommends the adoption by the Association of the U. S. standard for nuts, based on single size, regardless of finished nuts.

Fourth. That the Committee be instructed to prepare a circular calling attention to the importance of maintaining the standards of screw threads, and that the Secretary send copies of this circular to all members, general superintendents, general managers and railroad newspapers.

REPORT OF COMMITTEE ON BOILERS FOR HIGH-PRESSURE LOCOMOTIVES:

The drawings referred to in this report came in too late to be engraved. The blue prints are in the hands of the secretary. The cuts of these will be given in these columns when made, together with the opinions of the railroad men and the locomotive builders who have sent in answers to the circular issued.

Your Committee on "Boilers for High Pressure Locomotives" concluded, as the number of roads using high pressure steam on their locomotive boilers was limited, to request the information regarding boilers of this class (the Belpaire included) direct from the (motive power) officers of these roads, in preference to the usual method by circular.

Your Committee was somewhat at a loss to know what constituted high pressure on a locomotive boiler. It is not long since that 150 lbs. was considered high. This has become common. We therefore concluded to call anything in excess of 150 lbs. high pressure. Your Committee has not obtained such information as to the action of these boilers in service, because it is of a comparatively recent date that such high pressures have been used, and most of the boilers being so new they probably have not given much trouble. We are under the impression that trouble will develop with broken stay bolts at top of firebox in all types of boilers. This trouble can be mitigated by increasing the length of stay bolts at that part of the boiler by reducing width of firebox at top. Some of the tubes would have to be left out, but this would be offset by increased life of stay bolts and freer steaming. The reduction of tranverse strains in stay bolts obtained by increasing their length is much greater than generally supposed. The reduction of width of water space, consequently length of stay bolts at top of firebox, is exceedingly bad practice. The double riveting and increased size of mud ring to resist the downward pressure of firebox is important on all high-pressure boilers. The radial-stayed boiler is coming into more general use and has been found to be a strong, reliable boiler. The objection urged against the angles of the stays and difficulty of keeping them tight has not been found valid in practice. If the holes are threaded in outside sheet with a short tap, then threaded in crown sheet, instead of both holes at same time with one long tap, and the stays enlarged at points where they fit in sheets, and thread cut on there, there will be the same thread but from different starting points, and trouble with leaking and loose stays.

Your Committee have knowledge of fifty radial-stayed boilers, with stays riveted over outside and inside, that in seven years have not found a broken stay on the crown-sheet or trouble from sediment collecting. Staybolts have broken on side-sheets, but not more than on boilers with crown-bars or fireboxes. It looks as though the radial-stayed and Belpaire-type were the coming boilers. The Belpaire is not so well known as the other, but its merits will soon be understood and appreciated. The Belpaire boiler costs about $150 more to manufacture than the ordinary boiler. The objections to the boiler, with crown-bars and sling-stays for high pressure, have been fully described by Mr. Wells. The butt-joint has been generally accepted as the best, though the covering-plates make a resistance to the boiler retaining true circular shape in expansion. The ideal boiler is one without joints, but as we cannot have that, we should have as few joints as possible. Waist or cylinder part of boiler should always be made in one sheet. Outside shell of firebox should also be one, and when radial stays are used inside sheet could be a single one. The blue prints accompanying report show the most advanced construction of the different types of boilers for high pressure steam and are worthy of close study. The locomotive builders furnish designs as called for by their patrons. The thanks of your Committee are due to locomotive builders for prints and courteous offers of assistance in this work.

JAS. M. BOON, H. D. GORDON, J. S. GRAHAM, J. H. MCCONNELL, *Committee.*

On motion, the report was received.

Mr. H. D. GORDON: It is only quite recently that it has been the practice to carry excessively high pressure—in fact, only since the advent of the compound engine. One thing is well settled and that is the old crown bar type has about gone out of use and the radial stay and the Belpaire type seems to be the most in favor. The point has been raised that with a radial stay boiler, the stays not going through the sheets in the right angles, good threads cannot be had. But that is not sustained in service. There are hundreds of radial stay boilers running to-day that are doing well and giving no trouble. The Belpaire type has advocates, principally from the fact that the flat surfaces can be stayed directly to each other. Perhaps the most troublesome thing about a boiler of exceedingly high pressure is the matter of broken staybolts. We know that this occurs principally in the top rows. The best remedy I know of is to make the top rows longer. I do not think that in the past the practice has been good in that respect, and I think it is becoming more generally appreciated that the longer you get the top bolts the freer you are from breakages.

Mr. CHARLES BLACKWELL: I think better results could be obtained with staybolts by using the Whitworth thread.

Mr. A. E. MITCHELL: We are getting very good satisfaction indeed from our radial stay boiler, and are using them altogether.

Mr. LAUDER: I have used for eight years pressures ranging from 170 to 190 lbs., and careful designing, good workmanship and good material must be used to stand these enormous pressures. The fewer longitudinal seams we have in a boiler the better.

Mr. VAUCLAIN: We manufacture in the neighborhood of 1,000 boilers every year. I think it would be well to turn down all staybolts between centres. If one boy can handle a machine that will cut eight staybolts at one time, I do not see why anybody should question the expense of doing it. You may pursue any method you please to make the bolt, so long as you use the proper material. If you take steel that is high in tensile strength it will stand more vibrations. So it is with staybolts. I believe in using an iron for this purpose as hard as you can get it. We use an iron of tensile strength from 50,000 to 52,000 lbs., from 20 to 25 per cent. elongation in an eight inch section. I would say a word about the thickness of staybolts and the thickness of plates in the high pressure boiler. You should proportion your sheets according to the factor of safety desired, and you should proportion the diameter of your staybolts according to the load they have to carry. If this course is pursued, I do dot think you will have any trouble with staybolts in the radial stayboilers. We do not only increase the size of the stay bolt iron, but we also decrease the space between the bolts. In a locomotive boiler the thinner you can get the firebox plates, the longer life you get. If we reduce the space between the bolts in proportion to the pressure carried we would get them perhaps too close for service; that is, the staybolts would be so close together that the boilers would clog up with mud. As we increase the size of the bolts we simply keep our staybolts sufficiently far apart to keep the sheets from bulging.

Mr. REUBEN WELLS: The diameter of the staybolt should be proportioned somewhat to the thickness of the sheet through which it passes; that is, a seven-eighth bolt will break sooner when it is put through a half sheet than it will through a three-eighth sheet, for the reason that the thicker sheet is so stiff that the expansion of the inside sheet, when it forces the bolt out of its original position, the bolt itself must spring; while if it is a large bolt in proportion to the thickness of the sheet, the sheet itself will give somewhat in the direction of the strain, and thus relieve the staybolt. Another matter tending to increase the life of the staybolt is, to increase its length. The longer the bolt the longer its life will be, other things being equal.

Mr. R. C. BLACKALL: My experience with a Wootten firebox and radial stays is not satisfactory. We have had several of those crown sheets fall down. In the past year I have read of a large number of boiler explosions throughout the country, and I presume we have here representatives of the roads where that happened, and I would like to know what class of boilers it was that they had that trouble with.

Mr. VAUCLAIN: I would say that in the Wootten boilers that we have built we have had no more trouble than in any other type of boilers; and I think where explosions have occurred it has been from the same cause that would make other boilers explode.

Mr. A. E. MITCHELL: We have some Wootten boilers, and we are carrying from 150 to 185 lbs. of steam, and we find no more trouble than we do with other boilers, and they are giving us excellent service.

AIR BRAKE AND SIGNAL INSTRUCTIONS.

This report is about the same as was printed last year and copies of it can be obtained from the Secretary of the Association. In a supplementary report the committee recommended that the main report be changed in the same manner as recommended at the M. C. B. Convention and further recommend that:

"When under a full application the brake piston travel is found to exceed 8 in. upon a passenger car or 9 in. upon a freight car, the brake shoe slack must be taken up and the adjustment so made that the piston shall travel not less than 5 nor more than 6 in. Changes corresponding to this should also be made in the first paragraph of page 6, in the clause relating to adjustment upon page 13, and in answers to questions 56, 58, 111, 112 and 131." These recommendations were adopted.

The Committee on Subjects reported that in addition to the continued subjects they would suggest the following which were adopted:

Standard diameters for wheel centres and tires, for both larger and smaller sizes than those now accepted.

Boiler attachments and means for increasing their safety and lessening the number of holes in boilers.

Extent, utility and cost of malleable castings.

Attachment between engine and tender, to increase safety and prevent tender mounting foot board.

Foot steps and hand rails.

Best means of preventing the smoke nuisance, when using soft coal in cities.

The Committee on Resolutions then presented the usual complimentary resolutions, extending the thanks of the Association to all individuals and corporations who have united in the endeavor to render this session of the Convention as pleasant as possible.

For the next place of meeting Put-In Bay and Waukesha were suggested.

The following officers of the Association for the ensuing year were unanimously elected:

President—John Hickey.
First Vice-President—William Garstang.
Second Vice-President—R. C. Blackall.
Treasurer—O. Stewart.
Secretary—Angus Sinclair.

On Tuesday the members and friends of the Association visited the Schenectady Locomotive Works, where they were very agreeably entertained at a lunch, which was given in the anteroom of the drawing office. In the evening a reception was given at the Grand Union Hotel by the Schenectady Locomotive Works. A special train was tendered to the Association for the trip to Schenectady by the Delaware & Hudson Canal Co. The Association is indebted to Mr. H. G. Young, Second Vice-President of the D. & H. C., for the convenience of the arrangements made for transportation during the stay in Saratoga.

Building in Chicago from an Engineering Standpoint.*

As a consequence of concentration of business on a small area property lying within that area has always been very valuable as compared with that exterior to it. This fact has made it a great object to owners to build very high buildings on their lots. In the very nick of time the elevator put in its appearance to make a 16-story building with it more convenient than a four-story one had been without it. And so it is practicable, on a given area of ground surface, to get four times the rentable floor space that could have been had with the old-fashioned four-story buildings. The rental of offices in the business district amounting to about $1.50 per sq. ft. per annum landlords were naturally anxious to build many-storied buildings, and to economize floor space to the last degree.

But a tall building, if of the same construction as a low one, will be proportionately heavier. And here comes in the first troublesome condition of our problem. The material underlying the surface is clay, varying in consistency from firm to very soft at different points and different depths, these variations occurring often within the area covered by a single building. Its sustaining power, as determined by many tests that I have made with actual loads, is from 2,500 to 4,000 lbs. per square foot. It is the common practice of Chicago architects to load the soil at the rate of 3,000 lbs. per square foot. Under this load a small initial settlement takes place within a few hours, due to compacting of the soil at the surface upon which the load rests, and in part, perhaps, to displacement of water from the earth immediately adjacent to this surface by pressure of the loads applied. No further measurable settlement took place during the time (some weeks) covered by my longest experiments; but experience with heavy buildings shows that in the course of months and years they do continue to settle when the soil is not loaded to exceed the limit above stated. Experience also shows that while the initial settlements under a given load may be uniform throughout the area covered by a building, the progressive ones may eventually so differ as to cause serious cracks and demoralization in the structure.

The slow progressive settlements result from the squeezing out of the water from the earth—as was clearly seen while the wells were being sunk under the stage of the Auditorium for receiving the hydraulic cylinders used for operating the scenery. I sank these wells after the adjacent walls of the buildings were built. Some of them went to a depth of 24 ft. below the footings of the foundations and were only 4½ ft. from them. The weights resting on the soil amounted to 30 lbs. per square inch, or 4,230 lbs. per square foot. I had made the borings and tests of the soil and knew the nature of the materials at different depths well. The clay, which was of the usual character when the borings were made, had all become compact and hard, and contained very little water—none had to be pumped while the wells were being sunk. Extraordinary precautions were taken to prevent the movement of the earth around the walls, as such movement might have caused serious settlements of the walls. Strong steel rings were used, and tongued and grooved sheathing was driven outside these rings, and kept well in advance of the excavation as this proceeded. We got the wells down without the slipping of a spoonful of earth outside of them, and this without the difficulty anticipated—owing to the improvement that had taken place in the material, as described.

In view of the great height, and consequent great weight, of our principal buildings, it is important that materials should be used in their construction which unite in the highest degree lightness and strength with the other qualities of good building materials. And so steel naturally came to the front.

But with each change of temperature the steel skeleton expands or contracts and becomes a creeping, crawling thing, apparently striving to throw off its clothing, especially if exposed to such heat as results from the burning of the great quantities of combustible materials collected and stored in a mercantile building, or from the occurrence of great heat in the burning of adjacent buildings; and this last danger may threaten even an office building, which itself contains very little combustible material. And this in spite of the means usually employed to protect the metal from heat—the tile covering put upon it; for this covering will become so hot as to conduct enough heat to the steel to expand it and to crack off the tile. This has happened already, notably at the burning of the Tribune Building at Minneapolis about two years ago, which resulted in its utter destruction.

There may be steel buildings in which the fireproofing has been so well done that they will pass through an ordinary fire without such failure; but if the steel becomes even moderately heated, its stiffness will be measureably diminished, and the strength of the upright members so reduced as to cause them to bend and yield. This is the more likely to occur since the horizontal beams and girders will at the same time expand (unequally from the different degrees of temperature) and throw the posts out of vertical and into buckling positions, in which case the building will be likely to come down with a crash.

Under these circumstances, if floors were built of perfectly rigid materials the unequal settlement would crack them into pieces and ruin them. The elasticity of the steel beams now used in the floor system partially obviates this difficulty, but not wholly, as many floors in which they are employed—notably those of the Post Office and Custom House buildings—are badly demoralized and broken up by unequal settlements. This is the fourth difficulty, and our present system does not seem to provide for it satisfactorily.

But supposing we have succeeded in overcoming the great difficulties already pointed out, if steel and iron are used as principal parts of our buildings, and if these parts are not perfectly protected from corrosion, the building will still be comparatively short-lived.

There are many imperfections in minor details—such as weakness of brackets and their fastenings, want of proper provision for resistance of strains resulting from wind pressure, etc.—which we need not here describe or discuss. They are only alluded to because they are liable to occur in the class of building we have under consideration unless they are guarded against by the architect who designs and the superintendent or contractor who builds the structure.

Having thus considered the difficulties of our problem, let us endeavor to discover the proper remedies for them.

And first, we must, if practicable, secure an unyielding, instead of a yielding, foundation. In the central and northern parts of the city, near the lake, the soft materials described are underlaid by rock at a depth of from 60 to 100 ft. The rock rises to the southward and westward, coming to the surface at points in the western and southwestern parts of the city. Wherever it is practicable, the foundations of heavy buildings should rest upon the rock, or upon the hard-pan immediately overlying it.

As timber is everlasting under water, excavations for foundations can be made well below water surface in the lake, and piles can be driven in the bottom of such excavations down to the rock, or into the hard-pan immediately overlying it. These piles should be cut off at a level below that of any conceivable deep drainage system that may become desirable or necessary in the city (say, 15 ft. below city datum). Platforms of timber and concrete should be laid on the piles, and on these platforms, pillars or walls of masonry or concrete should be carried up the level of the basements, or sub-basements of buildings. In this way sub basements could be provided in which the machinery necessary for operating elevators and electric lights, and for heating and all other purposes, could be accommodated, leaving the first basements free for other uses; and thus making them rentable at high rates. The enhancement of the valve of property consequent upon this increase of rents would far more than pay for the deep system of drainage, which the city of Chicago so much needs.

A pile driven at the bottom of a pit 30 ft. deep and well into hard pan, or to the rock, where this is within reach, may be safely relied upon to sustain from 30 to 40 gross tons. And in cases in which the rock is within easy reach by wells, say, at a depth not exceeding 60 ft., they may be sunk to the rock and a pillar or column of rubble masonry or concrete may be carried up to the level of the basement or sub-basement floor. Careful estimates show that these foundations will cost less than those which are now generally employed; namely, platforms of steel and concrete, resting upon compressible soil.

Our safe and accomplished architects Adler and Sullivan have taken a long step in the direction of the plan of foundations above recommended, in causing piles to be driven under the foundations of the German theatre they are now building on Randolph between Dearborn and Clark streets. The foundation of the county building in Chicago also rests on piles; but these were so small and so carelessly driven that they are of nowhere near full value. Some elevators and warehouses, the shot tower, and other structures rest upon pile foundations simply, but I know of no instance in which wells or pits have been sunk and piles driven to the bottom of them in order to reach the rock or its equivalent, and to place the pile heads and the platforms built on them below the level of perpetual moisture when the deep drainage the city so sorely needs has been secured; and there is no instance in which foundations of stone-masonry or concrete have been carried down to the bed-rock as here suggested. By the construction of foundations of this character, we dispose of our first, second, and fourth difficulties; namely, placing heavy buildings on a weak soil, unequal settlements of different parts of the same building resulting from the unequal sustaining power of the same soil, and the consequent cracking of walls and floors.

The third difficulty, resulting from the expansions and contractions of metals employed in the construction of tall buildings, may be obviated by protecting these metals absolutely from any considerable change in temperature, or by throwing out the metals altogether and substituting tile, brick, and stone as far as may be practicable. As the weights to be borne by the vertical members of buildings such as we have described are very great, it becomes necessary to use materials and modes of construction which will make these vertical members as small in cross section as may be consistent with the loads they have to carry, in order to economize floor-space, which is the revenue-producing part of the building.

Now, first class cut-stone masonry laid in hydraulic cement mortar has less than one-fourth the compressive resistance of the stone of which it is composed. If, therefore, the stones themselves can be placed in absolute contact, without the interposition of mortar, it is fair to presume that much greater compressive resistance of the material would be obtained. To test the truth of this supposition I had a square pillar of Lemont limestone made by the Western Stone Co., one square foot in cross section, and about nine feet high. It was composed of seven stones taken from their thickest stratum, and so cut as to lie on the natural bed in the pillar when this was set up. The bearing surfaces of the blocks were planed perfectly true. I sent this pillar to the government testing machine at Watertown, Mass., and asked that it be set up by simply washing the beds with a very thin grout of the best English Portland cement. This pillar was subjected to the entire crushing power of the machine—800,000 lbs.—and it was only when the full strength of the machine was employed that the pillar showed the slightest symptom of yielding. Then small flakes were chipped off of the outside surfaces of two of the blocks, which is proof conclusive that the pillar was on the point of yielding. If pillars or columns having a cross section of 4 sq. ft. instead of one were used, the total resistance of such pillar to crushing would be far more than four times 800,000 lbs., for it is a well known fact that the crushing resistance of any substance increases in greater ratio than the area of cross section of the test specimen.

If, however, we assume that the strength is increased in that simple ratio, a pillar of Lemont limestone two feet square made as already described, would sustain a weight of 3,200,000 lbs. One third of that load, or say 1,000,000 lbs. would be a safe load for such a pillar. If we add a covering 2 in. thick on all sides of a pillar—which is sufficient to afford it all necessary protection from fire if a method is used which will shortly be described*—the whole size of the pillar so protected would be but 2 ft. 4 in. each way, which is but little larger than many of the steel columns with the fire-proofing now used. These pillars would, of course, decrease in size as the loads decrease, story by story, from bottom to top of the building. The blocks of which they are composed may be doweled by a steel rod running down through the centre of the pillar and connecting cap plates of cast iron that should be put on the pillars at the level of each story. These plates may project sufficiently to furnish a support to arches of tile, or béton Coignet, which should be used for the floor systems. In wide buildings the pillars should be set in right angles to each other, and at suitable distances to make it practicable to construct the whole by a groined arch or dome system supported by these pillars.

This system of floor construction is by no means new, as it has been in use for centuries in Spain and Italy. It has been recently introduced into this country by a Spanish engineer, Mr. Guastavino, and has rapidly come into use in our eastern cities. It has been found practicable to make strong floors with a very slight rise of the arch in proportion to its span. Steel rods have recently been built into the material of the floors thus constructed, so placed as to resist the horizontal thrust of the arches.

If the mode of construction here pointed out is adopted the building would be practically unchangeable in its dimensions, indestructible by fire, abundantly strong, and as durable as the materials of which it is composed. It also seems, from the best estimates I can make, that a building constructed in this way will cost less than one with steel and iron framing.

DISCUSSION.

W. L. B. JENNEY: There is almost no limit to the possibility of protection from heat by fire-clay. Take, for instance, blast furnaces. They are constructed of iron and steel, protected from heat by fire-clay, and in spite of the temperature being 3,500 to 4,000 deg., day and night, these furnaces last four years before they have to be renewed. We fire-proof according to the use to which the building is to be put. It is entirely possible to make a fire-proof building which would stand the test of a fire from petroleum on every floor. General Sooy Smith mentions the Minneapolis Tribune Building as an example of a fire-proof, steel-frame building which went to pieces in a fire. That is not a fair example, as I have been informed, by one of the tenants of that building at the time of the fire, that the part that burned was never claimed to be fire-proof, and that the part of the building that was fire-proof did not burn. As for the use of limestone pillars instead of steel, limestone behaves worse than steel when subjected to heat, and to make it serviceable it would have to be fire proofed as much as steel.

As to the deep piling with tops 15 ft. below datum, recommended by the General, while it would doubtless be a good thing, it is unnecessary in my estimation, and would be only a waste of money. The high buildings put up on foundations supported by piers at datum are proving highly satisfactory. For instance, the Home Insurance Building has settled so uniformly that the greatest variation throughout is only ¾ in. The difficulty with General Smith's proposed sub basement would be that large pumps would have to be constantly worked to keep it dry. Chicago sewers are about 2 to 4 ft. above datum; and the large quantities of seepage into a basement 15 ft. below datum would entail a constant and heavy expense for pumping.

D. H. PERKINS (manager for D. H. Burnham): We favor the iron and steel construction and look upon it as the very best there is. All our buildings for 1892 will be built in that way. In my opinion an iron or steel column covered with fire clay will stand more heat than anything yet known. It will take more heat to penetrate this coating of fire-clay than will be generated by the combustion of any ordinary merchandise or furniture. As to the piling principle we do not use it and all our buildings stand on separate column footings which rest on the blue clay. We have not found that piles are necessary and our buildings have not suffered for lack of them.

* From a lecture by Gen. W. Sooy Smith before the engineering students of the University of Illinois. Reprinted from the *Technograph*.

* After the lecture the speaker exhibited a plate of a lately invented fire-proofing, consisting of a mortar composed of one-fourth ground talc and three-fourths plaster of Paris, spread upon the two sides of a steel wire netting. The plate exhibited was about three-quarters of an inch thick and 15 inches square. It was stated that this particular plate had been heated to a white heat on one side for half an hour, and then the other side placed on a man's hand who carried the plate away without any unpleasant sensation.

TECHNICAL.

Manufacturing and Business.

The Standard Railway Gate Co., of Saginaw, Mich., filed a charter last week, with the capital stock placed at $50,000.

The Burtis-Patterson-Sergent Paint Co., of Cleveland, O., is to build a new brick addition at Wasson and Hamilton streets, Cleveland, to cost about $12,000.

The Caswell Stock Car & Transportation Co., of Chicago, has been incorporated to construct and operate special cars for the transportation of live stock. Moses H. Naber, 415 The Rookery, Chicago, is the principal stockholder.

The Falls Hollow Staybolt Company has received orders in the last few weeks for its mandrel—rolled hollow staybolt iron, from the Michigan Central, the Manhattan Elevated, the Long Island and the Delaware & Hudson Canal Company.

At the recent annual meeting of the Perkins Electric

Switch Mfg. Co., the former directors were re-elected, and the following officers: President and Treasurer, Charles G. Perkins; Vice-President, J. S. Gibbs; Secretary, Frederick W. Davis. A dividend of 3 per cent. on the earnings of the past six months was declared.

The directors of the Westinghouse Air Brake Co., at Pittsburgh, June 21, declared the regular 5 per cent. quarterly dividend, and 5 per cent. extra, making 10 per cent. in all, payable July 10. This makes three extra dividends of 5 per cent. each and two quarterly dividends of 5 per cent. each, or 25 per cent. in all, for the first six months of the current year.

Public subscriptions to the common stock of the Barney & Smith Car Co., of Dayton, O., recently organized to succeed the Barney & Smith Manufacturing Co., were invited in New York last week. The financial statement stated that the capital stock is $2,500,000 of eight per cent. cumulative preferred stock, $1,000,000 common stock, and $1,000,000 six per cent. bonds have also been issued. The preferred stocks and bonds were subscribed for privately. The company now employs 1,700 men, and its works cover 28 acres of land. The profits for the last six years, it is stated, have averaged over $380,000, equal to 12 per cent. on the common stock.

New Stations and Shops.

The St. Louis Southwestern proposes to build a roundhouse at Tyler, Tex., on land recently purchased, and it is reported that new shops may also be built.

The Denver Union Depot Co. has given the contract to the Pittsburg Bridge Co. for an iron shed about 700 ft. long adjoining the Union Depot building.

The contract has been let for building new shops at Meridian, Miss., for the Queen & Crescent system to replace those burned a few months ago. The new structure will be of brick about 500 ft. long, the cost being $50,000.

The Berlin Iron Bridge Co., of East Berlin, Conn., is building a new machine shop for the Solvay Process Co., at Syracuse, N. Y. The building will be 50 ft. wide by 300 ft. long and three stories high. The side walls will be of iron and brick (combination construction) with iron floors and iron roof covered with the Berlin Co.'s patent anti-condensation roofing.

The Chicago, St. Paul, Minneapolis & Omaha will build the following brick and stone addition to the locomotive repair shops at St. Paul: Boiler shop 100 ft. × 60 ft.; carpenter shop and pattern storehouse combined, 150 × 50 ft.; roundhouse, 10 stalls, completing the circle. The roof of the roundhouse will be asphaltum, while slate will be used on the other buildings. John Nevins & Son, of St. Paul, have the contract for stone and brick work, and the wood work will be done by the company under the direction of W. S. Darby, Inspector of Bridges and Buildings.

Work has been commenced on the shops of the Illinois Central road at Burnside, between Ninety-fifth and Ninety-ninth streets, Chicago. The company owns 160 acres at Burnside. The buildings to be erected this year will be as follows: Machine and erecting shops two stories high, 550 × 160 ft.; boiler and blacksmith shop, 550 × 100 ft.; brick power house for boilers, 60 × 80 ft.; brick storehouse, two stories and basement, 60 × 300 ft.; 40-stall roundhouse, with a 40-pocket coal chute, sandhouses, oil-house, etc.

Iron and Steel.

At a meeting of the Directors of the Tennessee Coal & Iron Co., held in New York this week, the purchase of the De Bardeleben Co., on terms already published, was confirmed.

An Electric Locomotive.

The largest electric locomotive in the world will, it is said, be completed this summer at the works of the Swiss firm, Messrs. Brown, Boveri & Co. It will have dynamos rated at 1,500 H. P., capable of being run up to 2,000 H. P. There will be eight driving axles, each fitted with a motor.

St. Clair Tunnel.

During a recent heavy rain storm three feet of water stood all night in the tunnel under the St. Clair River. he water drained in from Michigan and Canada and the downpour outside was so heavy that all efforts to clear the tunnel of rain water were unavailing. Trains were delayed. The water was pumped out early the following morning.

Canadian Patents.

The Dominion Senate has passed a bill to amend the Patent Act, to extend the life of a patent from 15 to 18 years' and to do away with the necessity for models. The bill was introduced at the request of the Canadian Inventors' Association.

Electric Transmission of Power.

The *Schweizerische Bauzeitung* gives an account of an electric power transmission installation, now in course of construction at Albino, near Bergamo (Lombardy), which, it is stated, will combine a degree of completeness with simplicity not yet equaled by other similar plants. The primary power will be furnished by the River Serio, across which a dam has been built for storage purposes. The water will be carried to a turbine station at Cene through a canal 800 meters (2,624 feet) long, and a main 550 meters (1,804 feet) long and 1,800 mm. (6 feet) in diameter, the available head at the station being 15 meters (about 50 feet).

There will be three turbines of 325 H. P. each, which will drive the generator armatures directly, without the intervention of belting or gearing. The current will be carried through a line supported on wooden poles for a distance of 3,000 meters (nearly 2 miles) to supply the spinning and weaving mills of Messrs. Honegger, Spoerry & Co., at Albino. The motors in the mills will drive a number of line shafts by rope transmission. The commercial efficiency of the whole system is placed at 80 per cent.

The canal work is in the hands of F. Largin, of Luzerne; the turbines will be furnished by Messrs. Escher, Wyss & Co., of Zurich; and the generators, motors, and conductors will be supplied by the Oerlikon Machine Works.

A Traveling Electric Dock Crane.

A portable electric crane was recently installed at one of the Hamburg (Germany) docks, having a span of 42½ ft., a height of 16½ ft. and a length of travel of about 98½ ft. The pivoted arm of the crane measures a little over 36 ft., and is worked by a small electric motor. Hoisting and lowering is accomplished by a second motor fitted with worm gearing. The current is carried by underground wires from a central station.

A New Climbing Locomotive.

An invention for enabling a locomotive and train of cars to ascend steep gradients has been patented, and a working model of it was recently inspected by us at the offices of Messrs. Pocock & Co., 64 Cannon street, London. In this device a grooved drum is keyed on the driving wheel axle, the drive being sufficiently wide to allow a stationary cable to be coiled once around it. The drum is of the same circumference as the driving wheels, so that with each revolution of the driving wheels the drum travels a full revolution over the cable. This cable lies in the centre of the track, and is secured at either end and kept in its position round curves by guides. It is shown by the model that the assistance given by the turn of the cable round the drum and the slight strain exercised at each end of the cable are sufficient to give the driving wheels the necessary grip or bite on the rails to allow them to gain the full length of their circumference at each revolution. The model now exhibited ascends a gradient of one in three, passing round a sharp curve at the same time. It is claimed that by this system the wear and tear of the cable are reduced to a minimum, as it rests on the bed of the track while the drum passes over it, the table at all other times lying quite inactive.—*Iron* (London.)

Electric Search-Light for Mt. Washington.

General Manager Tucker of the Maine Central Railroad says the necessary money for placing an electric search-light on the top of Mount Washington has been subscribed. The light will be the highest and strongest in the world; and will be visible from Maine, Massachusetts, New Hampshire, Vermont, New York and Canada.

Paint for Hot Air Pipes.

According to the *Moniteur Industriel* an incombustible paint or varnish for hot air conduits is obtained by mixing yellow talc with some heavy mineral oil in sufficient quantity to form a mixture which can be well held by a brush. The tubes or conduits to be treated are given a thick coat of this varnish and are then treated in a furnace, this two-fold operation of varnishing and baking being repeated several times if necessary or desirable. The coating is said to adhere very well, to give off no odor when the conduits become hot, and to admit of being highly polished by rubbing with a greasy rag.

Launching of the Largest Steel Lake Steamer.

The largest steel steamer on the Great Lakes was launched June 9 at South Chicago at the yards of the Chicago Shipbuilding Company on the Calumet River. It was christened the "Maritana." The "Maritana" is built of steel throughout, has a water bottom with compartments and has the usual bulkheads through the hull proper. There are also collision bulkheads in the hull, fore and aft. The dimensions of the steamer are as follows: Length of keel, 330 ft.; length over all, 348 ft.; extreme breadth of beam, 45 ft.; depth of hold, 24½ ft.; triple expansion engines, 24, 39 and 63 in., with 48 in. stroke, steam being supplied by three 12 × 12 steel boilers. One hundred and sixty pounds steam will be carried. She will carry about 4,000 tons, and will attain a speed of about 14 miles an hour. The cost of the steamer is about $250,000. She was built for general traffic, but will be used in the iron ore trade. The steamer will be lighted throughout with electricity.

Uniformity in Safety Equipment.

The General Manager of the Chesapeake & Ohio has issued the following order, under date of June 10:

"The passenger trains of this line are equipped with the Westinghouse quick-acting automatic air-brake, the Westinghouse train signal, and Janney couplers. It is thought proper that all cars, including special and private cars, offered for movement in the passenger trains of this line, should be similarly equipped. Cars not equipped with the Westinghouse air-brake, the Westinghouse air signals, and Janney couplers, or a coupler of the Master Car Builders' type, which will work in close connection with the Janney, are not to be moved in the passenger trains of this line without special permission from the President or General Manager. Cars equipped with the 'Janney Hood' will not be accepted."

Electric Street Roads in St. Louis.

An issue of bonds to the amount of $1,800,000 has been sold, the proceeds to be used for electric street railroad construction in St. Louis. The contracts for the work are about to be let. The purpose is to convert the Northern, Central, Union, Cass Avenue and Citizens' Street roads into a single electric system.

The St. Louis Union Depot.

Bids for the stone work of the new union depot at St. Louis were opened by the board of directors on June 20, and all the bids rejected.

Architect T. C. Link was instructed to invite new bids for the building in its entirety with the exception of interior decorations and a few minor items. The train shed, which is built separately, was begun some time ago and work on it is progressing rapidly.

THE SCRAP HEAP.

Notes.

Two spans of the Northern Pacific bridge over Clark's Fork River at Clark's Fork, Idaho, were burned June 19. This bridge consists of five spans, each 100 ft. long.

A fire in the car shops of the Rathbun Car Works a Deseronto, Ont., last week destroyed the south end of the erecting shops and some valuable machinery, causing a loss of about $20,000.

Dispatches from Cincinnati report that the number of persons killed by the bridge disaster there on June 15 was 26, instead of 40, as at first stated. Twelve persons were injured, of whom five are likely to die. The property loss is estimated at $20,000.

At Latrobe, Pa., on the evening of June 15 a number of men from a stone quarry became disorderly on a passenger train of the Ligonier Valley railroad, and on being asked to pay their fares started a riot, in which a brakeman was killed and two or three other persons badly injured.

Mr. Sidney Dillon, whose death was noticed last week, left $25,000 for the Young Men's Christian Associations for railroad men on the line of the Union Pacific, and $25,000 for Amherst College. These bequests did not appear in Mr. Dillon's will, but, his wishes being known, four of his heirs have voluntarily given the sums named, together with smaller sums to other religious and charitable objects.

The trainmen of the Michigan Division of the Cleveland, Cincinnati, Chicago & St. Louis have secured an advance in wages. According to the new schedule passenger engineers will receive 3.3 cents a mile; firemen 55 per cent. of engineer's salary; conductors, $118 a month; brakemen, $45; freight engineers, $4.20 for 112 miles; freight conductors, $85 a month, freight brakemen, $1.26 a day. This division was only recently taken into the "Big Four" system.

A cloudburst did great damage in Wisconsin on the night of June 15. At Boscobel five bridges were carried away, the water rising 11 ft. in Turtle River in a few minutes. The Chicago, Milwaukee & St. Paul track was washed out for a long distance. At Sparta one end of tunnel No. 3 on the Chicago & Northwestern caved in. North of La Crosse, on the river division of the St. Paul, there was a bad washout. At Prairie du Chien there was considerable damage to bridges.

The United States has begun an action against the Northern Pacific railroad, in the Federal Court at St. Paul, for violation of the alien contract labor law. It appears that E. Sherlock was, until June 1, an employé of the Northern Pacific at Winnipeg. At that time, the company having a better position vacant at Crookston, Minn., and he having done faithful service and being next in line for promotion, was appointed to the place. Now the federal government sues the company and demands $1,000 for violation of the law. Mr. Sherlock is still holding his place at Crookston.

A side collision of freight trains occurred in the Twelfth street yards at St. Louis on the morning of June 16, about 12:30 o'clock, between Merchants' Terminal and Missouri Pacific freight trains, by which two iron columns supporting the Twelfth street bridge were broken down, causing three spans, two of 30 ft. and one of 60 ft., to fall upon the cars below. These spans are I-beam or light plate girders, the bridge being an old one, erected about 1874. The City Engineer had recommended that it be removed, because of its insufficiency for the largely increased traffic. The daily papers place the damage to the structure at $5,000. It is estimated that the spans can be replaced for about $6,000. It is probable that there will be a temporary trestle put in for the accommodation of the traffic until arrangements are made for the re-building of the entire bridge.

The various railroad companies owning tracks in East St. Louis held a conference last week, and took measures to construct an embankment for the purpose of protecting their property from future floods. The Mayor of East St. Louis was also present, and the municipality will probably co-operate with the railroads. The ground on which most of the yards in East St. Louis are located is an island, and some of the land between this and the Mississippi is already protected. The Chicago & Alton track northward from the bridge, and the East St. Louis & Carondelet track southward from the bridge are higher than the other lines and constitute levees, but the integrity of these has not been maintained, so that the late flood did considerable damage in spite of their existence. The most important work to be done is between the "Relay" station near the east end of the bridge and "Bridge Junction."

Congress now has before it one more bill "To Promote Safety on Railroads." The House Committee on Interstate and Foreign Commerce has authorized Mr. O'Neill

of Missouri, to report favorably a bill containing the following requirements: Every new locomotive after July, 1893, must be equipped with power brakes, and after July, 1895, all locomotives. After July, 1895, all new cars, or old cars sent to the shops for repairs, must be equipped with automatic couplers, and after July, 1898, all cars must be so equipped. After July, 1895, all new cars (and after July, 1898, all cars) must be provided with continuous brakes to be operated by the locomotive. In July, 1893, every common carrier shall file with the Interstate Commerce Commission a statement stating the automatic coupler which it prefers. If any coupler receives 75 per cent. of the votes it shall be adopted as the standard automatic coupler. If no coupler receives the percentage the Commission shall within six months designate a standard automatic coupler.

Spanish-American Notes.

A Decauville railroad is to be laid from Jacinto Araoz on the Argentine Great Southern railroad, to the salt works at Salinas.

During the six months ending march 31 the Argentine Great Southern Railroad carried 50,000 tons of grain, against 29,000 tons for the same period of the previous year.

The sum of $8,000 has been appropriated for the construction of a bridge across the Rio Ilave, Peru, a short distance south of Puno, in the department of the same name.

Newspaper dispatches report a general strike of employés on the Gran Ferro-Carril de Venezuela, the strikers, who are mostly Italians, having joined the revolutionists.

The branch of the Southern Railroad which is to connect Puno with Cuzco, Peru, will be opened to traffic from its present terminus at Santa Rosa to Marangani during the present month.

The receipts for the week ending May 29 on four of the principal Argentine railroads, aggregating 3,037 miles of track, amounted to $171,300, being an increase of $15,000 over the corresponding week of 1891.

It is reported that a ship load of cedar from the territory of Misiones, on the Rio de la Plata, Argentine, is to be sent to the United States this month, which is the first of a series of similar shipments which are to be made.

The Nitrate Railways Corporation, Chili, has declared a 20 per cent. dividend, amounting to £200,000, besides carrying forward to the reserve fund £40,000, and bringing into the revenue for the current year the sum of £159,995. They also have a claim for damages done to the line during the recent Chilian revolution of £48,000, which claim they have reason to believe will be allowed by the Chilian government.

In spite of efforts to make the Ensenada Port, near Buenos Ayres, a profitable venture, it seems to be falling into harder lines continually. Not long since the contractors who had charge of these harbor works submitted an estimate of the probable traffic which would use this port, setting the amount at 250,000 tons per annum, yielding a revenue of $650,000. The actual traffic returns of the port for 1891 were 305,257 tons; but the financial returns netted only $60,530 paper, which at existing rates of exchange really amounted to no more than $18,000. In addition to this, dredging operations now going on in the channel leading to the Madera Docks in front of Buenos Ayres will soon enable large draught vessels to enter there, which will reduce the present patronage of the Ensenada Port, and must finally demonstrate the folly of that expensive effort to induce commerce to leave the highways for a by-path, even when the by-path does possess some advantages as regards easy access.

On the Aranco Railroad, Chili, is a bridge recently constructed across the Bio-Bio River, where the Brunlees system of disc-footed piles has been employed with success. The river is shallow, and its bed consists of sand to a depth of 150 ft. The bridge consists of 62 spans of lattice girders of 82 ft. each, resting on 61 piers of cast iron disc-piles, and end abutments of brick. The piers are formed of six piles each, in rows of three, the rows being 15 ft. apart, and the piles 6 ft. apart in the rows. The two middle piles of each pier are 15 in. in outer diameter, the walls of the cylinder being 1⅝ in. thick. The discs are 3 ft. 6 in. in diameter. The outer piles are somewhat smaller. The discs are of the ordinary shape, and were put down by the water jet system. The discs are 28 ft. below the level of the river bed, and 52 ft. below the bridge floor. The bearing power of the sand was tested to exceed 7.75 tons per square foot, while the estimated maximum pressure under a load of a train of heavy locomotives is 4.93 tons per square foot on the larger discs and 3.38 tons on the smaller ones.

World's Fair Notes.

The authorities have decided to have a fire boat to ply about the waters of Jackson Park as an additional precaution.

The recent wind storm blew down 275 ft. of the inner wall of the uncompleted Manufactures Building. The damage is estimated at $5,000.

The contract awarded to the Westinghouse Electric and Manufacturing Co. has been signed. The original bond of $1,000,000 was reduced to $500,000.

A letter received from the Canadian Minister of Marine, saying that the St. Lawrence canals would not be completed until after the World's Fair has been held, will interfere with the plans of the Eastern people who contemplated going to Chicago next year in their big yachts.

The various world's congresses will be held substantially as arranged, whatever may be the result of the present controversy concerning the Art Institute Building. The Directory of the Exposition has undertaken to provide adequate places of meeting for the various congresses, and has set apart an ample fund for that purpose.

Plans are being considered for a new pier in Lake Michigan, on the exposition grounds. The present pier is considered inadequate for passenger boat service. It extends into the lake 1,000 feet, but the water about it is shallow, and an immense amount of dredging will be necessary to make it serviceable. The construction department proposes a pier that is to be extended in a semicircle, boats to discharge and receive their passengers within the inclosure.

The California World's Fair Commission has provided for an exhibit, both for their state building and in the departmental buildings. The mining bureau's collection will be sent by the state to Chicago as a part of their mineral exhibit. The departments of agriculture, horticulture and mining of California are about equally interested. The state building will contain in miniature the products of the state. An immense relief map showing the topography of the state is being prepared.

Director-General Davis conferred with the chiefs of departments regarding the applications for space and the amount of space not yet taken. Without any exception the requests for space exceeds the amount which can be disposed of. Applications received after July 1 will not be considered until all applications then on hand have been looked over in detail, when space will be allotted accordingly. Should there be any space left new applications will be considered.

The main shafting in the machinery building will be supported on the runways for the overhead traveling cranes, instead of being placed on the arches as first intended. There will be three different cranes—the Sellers, Morgan Engineering Co., and Yale & Towne. These companies will furnish the cranes and runways. The runways will be built by the Edge Moor Bridge Works. Plans for this work have been submitted, and it is expected to have it completed by the time the roof is placed.

Not the least interesting among the valuable collections of foreign treasures to be exhibited at the World's Fair will be the contribution of Pope Leo. This will embrace mementoes of Christopher Columbus, and will include two celebrated geographical charts now preserved in the Borgia Museum of the Propaganda. One by an unknown author is traced with the first discoveries made in America four centuries ago. This chart is drawn on parchment, and is of great historic value. The other chart, no less celebrated, was executed in 1529, and comprises the whole known world of that date, which includes those parts of America which had been explored.

The launches for transporting passengers through the inner harbor, lagoons, basins and canals are being tested by a committee of Exposition officials to determine their ability, seaworthiness and general adaptability to the service to be demanded of them. The boats will be loaded with bags of sand weighing 140 lbs. each, and corresponding in number to the passengers the boats are rated to carry. The test calls for 10 hours continuous running over a marked course, with full loads, and boats are required to stop at designated wharfs and make such manœuvres as the committee may suggest. The boats entered for the test comprise steam, electric-storage and pneumatic launches, and have a range in carrying capacity of 25 to 50 people. The tests will last several weeks. The successful competitor will receive the exclusive right to operate his launches upon the inclosed waters of the park.

Suez Canal.

At the general meeting of the Suez Canal Co. in Paris, May 31, it was reported that the tonnage in 1891 exceeded that of 1890 by something over 1,800,000 tons. The greatest increase was in the item of wheat, which was 525,000 tons. M. de Lesseps stated that except in the item of wheat the increase was apparently due to the normal development of traffic between the East and the West. He announced a dividend of 20 per cent. on the capital stock. It was announced also that there would be a reduction in the tariffs of about 50 centimes a ton, to begin Jan. 1, 1893.

Baltimore Elevated Road.

The Lake Roland Elevated Railway Co. has awarded the contract for the elevated structure on North street, between Lexington and Chase streets, Baltimore, to the Pennsylvania Steel Co. The contract includes masonry, materials and construction. The elevated structure will be double tracked for 4,000 ft., and with the double track viaduct 400 ft. long over the Baltimore & Lehigh Railroad Co.'s tracks at Stony Run, the contract for which has also been given to the Pennsylvania Steel Co., there will be nearly two miles of single track elevated roadway. The contract for the electric equipment has been awarded to the General Electric Co. The motors have arrived. The cars will be manufactured by the Pullman Co., and will be 24 ft. long. Samuel Jarvis, of the Jarvis-Conklin Mortgage Co., of Kansas City, is President of the company.

Longitudinal Sleepers in America.

England is not the only country that can boast of ancient styles of roadway. The Great Western of England, referred to in the *Railroad Gazette* of June 10, has a partial counterpart in Georgia, as will be seen by the following from a Macon paper:

"The line of the Southwestern division of the Central of Georgia is soon to undergo a very important change. The old stringer track on the main line between Macon and Columbus is to be taken up and replaced by steel rail, which will be placed on cross ties. The new rail has already been purchased. The rail from the main line stringer track is sufficiently heavy, and in good enough condition to replace the wornout stringer track on a great part of the line between Albany and Columbia. As far as it goes this rail will also be laid on the crossties. The traffic over this part of the road is not very heavy, and can easily be carried on with the second-hand rails from the main line. This will give all the Southwestern division first-class track."

Tracing for Cars.

A committee of the Car Accountants' Association has been collecting opinions about the value of car tracers, and has published some of them. One by Mr. C. H. Ewings, Car Accountant of the New York Central & Hudson River Railroad, pretty well summarizes the sense in all of them. He says: "I certainly consider car tracing as practiced by many railroads wasted energy in every sense of the word. I receive tracers every day from other roads when their own records should show that the car passed over our line merely as a transit car. I think it is safe to say that in at least 50 per cent. of all tracers received by me, the delivery to our connections is noted 10 days to two weeks prior to the date of tracer. I would also say that the very roads that are most persistent in tracing for their cars and claiming immediate return, are the very roads that hold foreign cars the longest and completely ignore any requests for their return. There is only one solution of this question, and that is per diem at 25 cents per day. This will obviate the necessity of tracing."

The New English Railroad.

At Chesterfield, on Tuesday, the first sod of the new Lancashire, Derbyshire & East Coast line of railway was well and truly cut in a field just outside the town. The new company has powers to raise a capital of 8,000,000 sterling, and proposes to spend all but half a million of this amount in the construction of a main line 130 miles in length stretching from Warrington, in Lancashire (where the railway joins the docks of the Manchester Ship Canal), to Sutton, on the open coast of Lincolnshire, 20 miles south of the Humber, of a first class harbor and dock at Sutton, and of some 44 miles of subsidiary junction lines and branches. Dividing the capital by the mileage, we find that each mile of the new line is to cost nearly £43,000. It may be divided into four sections—(1) Warrington, across the Cheshire plain, through Knutsford to Macclesfield, with a branch thence northward for 10 miles, giving access to Manchester; (2) from Macclesfield across the high tableland of the Peak, through Buxton, past Chatsworth to Chesterfield; (3) a section running due east for 50 miles across the great Derbyshire and Nottinghamshire coal field to Lincoln; (4) and finally, a section of 50 miles of line right across Lincolnshire to the sea at Sutton. The new railway will not depend upon passenger traffic. It is as much a coal line as was in the old days the Stockton & Darlington or the Leicester & Swannington, and to day the Taff Vale, the Rhymney, or the Barry; only instead of carrying, as these companies do, all its eggs in one basket to the same market, it looks to being able to send coal westward to Manchester and Liverpool, east to the North Sea and southward to London; and that the new undertaking will suffer from the lack of eggs to carry to these markets seems hardly likely, for they do their coal mining on a large scale in Derbyshire and Nottinghamshire. *The Times* (London).

CAR BUILDING.

The St. Louis, Vandalia & Terre Haute has let a contract for building 10 passenger cars to St. Charles Car Co.

The New York, Chicago & St. Louis is reported to have ordered 1,000 cars of 60,000 lbs. capacity, with air brakes and M. C. B. couplers.

The Buffalo, Rochester & Pittsburgh has let the contract for building 500 cars to the Jackson and Woodin Manufacturing Co., of Berwick, Pa.

The Chattanooga Car & Foundry Co. is preparing to engage in the manufacture of passenger cars, and is increasing its capacity for this purpose.

Eleven new baggage and express cars, recently built by the New York Central & Hudson River Road at its West Albany shops, have been placed in service.

BRIDGE BUILDING.

Blackville, N. B.—Henry Swim has the contract for the Blackville bridge, consisting of two spans, each 170 ft. clear, with long approaches.

Boston.—The contract for the Allston bridge was let to Cofrode & Saylor, of Philadelphia, the contract price being $18,940. There were three bidders.

Bow, Pa.—A new iron bridge has been erected at West tunnel, near Bow station, on the West Pennsylvania, replacing a wooden Howe truss which had stood for many years. The bridge is 435 ft. long, of three spans, and is 52 ft. above the water. The work was done without any detention to trains, the track being supported on trestles during the progress of the work.

Chicago, Ill.—The plans for the drawbridge over the West Fork of the south branch of the Chicago River at California avenue, and over the canal at Western avenue, were approved by the United States engineers last week, and the West Park Board, which is to build the bridges, will now have work begun on them immediately.

Clark's Fork, Idaho.—The Northern Pacific Bridge across the Clark's Fork River at this point was burned last week and a temporary combination structure is now being erected. It is the intention of the company to substitute an iron bridge which will be built in five spans of 130 ft. each.

Ellwood, Pa.—The location for a new bridge on the Belle Vernon division of the Pittsburgh & Lake Erie across the Beaver River at Ellwood, Pa., was decided upon last week, and the erection of the structure will probably be commenced at once.

Glengarry County, Ont.—It has been decided to construct an iron bridge across the Black River, at Martintown, Glengarry County. There are to be three iron bridges to replace the iron structures at the following places: McGillivary's bridge, half way between Martintown and Williamstown; Feeny's bridge, between the latter and Lancaster, and the third at the junction of the South Branch and Black Rivers, about a mile south of Williamstown. Tenders for the iron work have been submitted by Duncan Ross, the Dominion Bridge Co., and the Canadian Bridge Co. The cost will be close upon $12 a foot for a 94 ft. span, $13.50 for a 124 ft. one, and $17.50 for one of 160 to 170 ft. The stone work will cost about $8.90 a yard. Total estimate, $12,000.

Gloucester County, N. J.—The Gloucester County Board of Freeholders last week approved the plans for the new structure over Woodbury Creek. The new bridge will be of iron and the cost is not to exceed $10,000.

Livermore, Pa.—The long wooden bridge west of Livermore, on the West Pennsylvania division of the Pennsylvania, will be replaced with an iron structure this summer. With the work now being done at Butler junction, this will leave only one wooden bridge on the line.

Macon, Ga.—The contract for the construction of the combination bridge over the Ocmulgee for the Macon & Dublin railroad, has been let to Schailer & Schniglat, of Chicago. It is to be a Howe truss bridge, with two main spans, 160 ft. each in length, and two smaller spans 70 ft. each in length.

Nashville, Tenn.—The middle span of the Stone River bridge on the Lebanon branch of the Nashville, Chattanooga & St. Louis, burned last week, will be replaced at once by an iron span.

New York City.—The War Department this week granted a permit for a temporary bridge across the Harlem River at Fourth avenue, New York, for the use of the New York Central Railroad until the permanent bridge has been completed.

Parkersburg, W. Va.—The New York firm of Soliman & Kavanaugh have been awarded an extensive contract by the Ohio River Railroad for bridge repairs, stone work and culvert building. One of the principal pieces of work will be on the southern abutment of the bridge across the Kanawha River at Parkersburg.

Pittsburgh, Pa.—The Coraopolis & Neville Island Bridge Co. has been chartered to erect a bridge over the Ohio River from Coraopolis to Neville Island; capital, $3,500.

Quinton, N. J.—A new iron bridge is to be built at this town.

San Francisco, Cal.—The property owners on Charles street, this city, have petitioned the Board of Supervisors to erect a bridge at the intersection of the street and the railroad crossing.

Sioux City, Ia.—Work on the Fourth street viaduct, over the right of way of the Illinois Central and the Chicago, St. Paul, Minneapolis & Omaha, has been resumed. It was delayed by the high water and the consequent detention of material. The Lassig Bridge and Iron Works, of Chicago, have the contract for the superstructure, and Sooysmith & Co., of New York, for the foundation.

Tarrant County, Tex.—The Tarrant County Commissioners have let the contract for the erection of six new iron bridges to the George E. King Bridge Co., Des Moines, Ia. The cost of the six bridges will be $9,490. There were 16 bidders. The bridges are to be erected across the West Fork of the Trinity, Denton Creek, Sycamore Creek, Johnson Station Creek, Walnut Creek and Rock Creek. The contract for an iron bridge across Village Creek, west of Arlington, was let to the Youngstown Bridge Co. Other bridges are to be built by Tarrant County.

West Ferndale, Wash.—The County Commissioners have decided to build four bridges across the Nooksack River, one at Ferndale to cost $15,000, one at Lynden to cost $5,000, one at Everson to cost $6,000, and one at Nugents to cost $5,000.

West Point, Miss.—The County Supervisors have let contracts for building bridges to replace those destroyed by the recent floods. W. H. Converse, of Chattanooga, Tenn., received contract at $6,800 to build an iron bridge over the Squatouchie River.

Miscellaneous.—The Chicago, St. Paul, Minneapolis & Omaha road will replace seven wooden bridges with iron plate girder construction. The length varies from 14 ft. to 150 ft.; all of them will be built by the Lassig Bridge and Iron Works.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi-annual, 3 per cent. on the preferred stock, payable July 1.

Boston, Revere Beach & Lynn, semi-annual, 2½ per cent., payable July 1.

Chicago, Rock Island & Pacific, quarterly, 1 per cent., payable Aug. 1.

Dexter & Piscataquis, semi-annual, 2½ per cent. and a special dividend of 1 per cent.

Fitchburg, semi-annual, 2 per cent. on the preferred stock, payable July 15.

Norfolk & Southern, quarterly, 1 per cent. on the capital stock, payable July 12.

Oregon Railway & Navigation Co., quarterly, 1½ per cent. on the capital stock, payable July 1.

Rio Grande Western, quarterly, 1¼ per cent. on the preferred stock, payable Aug. 1.

Tennessee Coal, Iron & Railway Co., semi-annual, 4 per cent. on the preferred stock, payable July 15.

Toledo & Ohio Central, quarterly, 1¼ per cent. on the preferred stock, payable July 25.

Wrightsville & Tennille, semi-annual, 4 per cent.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Boston & Maine, special, Lawrence, Mass., June 20.

Brooklyn (Elevated), Brooklyn, N. Y., June 20.

Chicago Junction Railways & Union Stock Yards Co., annual, Jersey City, N. J., July 7.

Fort Worth & Trinity Valley, annual, Fort Worth, Tex., June 25.

Galveston, Harrisburg & San Antonio, annual, Houston, Tex., July 5.

Schuylkill & Lehigh Valley, special, New York, N. Y., June 27.

Wheeling & Lake Erie, special, Toledo, O., July 7.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Association of General Baggage Agents* will hold its next annual meeting at Mackinac Island, Mich., July 20.

The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November. By special resolution the next meeting will be held in April.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Engineers and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

American Boiler Manufacturers' Association.

The fifth annual convention of this association was held at Buffalo, N. Y., last week, beginning June 14. New officers were elected as follows: President, P. Rohan, of St. Louis; Vice-Presidents, Richard Garstang, of St. Louis; Charles Krochell, of Chicago, and Michael Geary, of Oil City, Pa.; Treasurer, Richard Hammond, of Buffalo, re-elected; Secretary, E. D. Meirer, of St. Louis, re-elected.

National Association of Freight Agents.

The annual meeting of the National Association of Local Freight Agents was held in Louisville, Ky., June 14 and 15. The meeting elected the following officers: James Trevelyn, St. Louis, President; Fred. Hudson, Louisville, Vice-President; D. W. Howard, Chicago, Secretary; Executive Committee, J. R. Semple, Evansville; T. J. Kern, Cincinnati; E. M. Wray, St. Joseph, F. J. Hill, Detroit; J. B. Lownsbury, Toledo; C. H. Newton, Fort Wayne.

National Association of Local Freight Agents.

The National Association of Local Freight Agents at its annual meeting in Louisville, June 15, elected the following officers: James Treviling, St. Louis, President; Fred. Hudson, Louisville, Vice-President; D. W. Howard, Chicago, Secretary; Executive Committee: J. R. Sample, Evansville; T. J. Kern, Cincinnati; E. M. Wray, St. Joseph; F. J. Hill, Detroit; J. B. Lownsbury, Toledo; C. H. Newton, Fort Wayne. The Association will meet next year at Milwaukee.

Railway Telegraph Superintendents' Association.

The eleventh annual meeting of this association was held in Denver, June 15 and 16, about 50 members being present. L. H. Kerty, of the Union Pacific, was chosen President for the ensuing year. Among the papers presented was one by Mr. Thomas A. Edison on "Insulation," which was read by Mr. M. B. Leonard. The treatment of the subject shows the hand of a master, but the paper is too long for publication in the *Railroad Gazette*. We shall give a report of the proceedings, with extracts from the other papers read, but have been compelled to postpone it for lack of space.

The Civil Engineers' Club of Cleveland.

The regular meeting of the club was held at the club rooms June 14. Mr. Irving Mason Wolverton was elected an active member. The discussion of the evening was on the annual address of the retiring President, Mr. Gobeille, on the subject "The Financial Status of the Engineer." Charles S. Howe, Secretary.

PERSONAL.

—President Roberts, of the Pennsylvania, will sail for Europe next week. He is not going on business, but entirely for his health.

—Mr. Hugh R. Irvine, Superintendent of Tracks and Bridges and Buildings of the Gulf, Colorado & Santa Fe, with headquarters at Galveston, Tex., has resigned.

—Major R. C. Jackson, a prominent banker of Knoxville, Tenn., and at one time President of the East Tennessee, Virginia & Georgia road, died at Knoxville, June 19.

—Mr. A. P. Man, Jr., General Manager of the Silver Springs, Ocala & Gulf Railroad, has tendered his resignation and the same has been accepted. Mr. Man's successor has not been named.

—Mr. E. M. Roberts has been appointed Superintendent of Motive Power of the South Carolina road. He was formerly Master Mechanic, but the position has been abolished and the above office created.

—Mr. Henry Millholland, who has been connected with the Mechanical Department of the Pennsylvania Railroad at Altoona, for a number of years, has accepted the position of Mechanical Engineer of the Gould Coupler Co.

—Mr. E. B. McNeill has resigned his position as General Superintendent of the St. Joseph & Grand Island on account of ill health. The office has been abolished. Mr. McNeill will go to his home at Litchfield, Conn.

—The recent reported appointment of Mr. J. S. Stewart to be Master Mechanic of the new Pennsylvania shops at Walls, Pa., was incorrect. He is now General Foreman of the car shops at Walls, and no change has recently been made in his position.

—Mr. S. S. Neff, who has been superintendent of the Pacific Coast Lines of the Great Northern, the Seattle & Montana, the Fairhaven & Southern, and the New Westminster Southern, has resigned. He was formerly Superintendent of the Cornwall road.

—Mr. Isaac D. Barton, General Manager of the New York & New England Railroad, who for many years was General Superintendent of the Long Island road, was this week presented with a gold watch, chain and charm by the employés of the Long Island road.

—Col. John C. Rose, for the past 28 years claim agent of the Pennsylvania Railroad Company in New Jersey, was killed at Marion Station on the Pennsylvania road, this week, by being struck by a train. Col. Rose was 61 years old. He was born at Windom, Greene County, N. Y.

—Mr. Rufus W. Martin, of Little Rock, Ark., President of the White & Black River Valley Railroad, died June 20 at El Reno, Indian Ter. He was stricken with paralysis in El Reno on Thursday. He had been President of the road since 1884, when it was called the Batesville & Brinkley. He was Secretary and Treasurer for the three preceding years.

—Mr. V. E. McBee, who recently resigned as General Superintendent of the Central of Georgia, will assume charge of the South Carolina lines of the Richmond & Danville on July 1 as General Superintendent, with office at Columbia, S. C. His jurisdiction will also include the Western North Carolina road.

—Mr. J. K. Bole, of Cleveland, O., who is President of the Solid Steel Co., of Alliance, O., and one of the Managing Directors of the Otis Steel Co., of Cleveland, was last week appointed one of the receivers of the Valley road of Ohio, which is controlled by the Baltimore & Ohio. Mr. Henry M. Keim, Secretary and Treasurer of the Valley road, was also appointed a Receiver of the road.

—Mr. D. B. Robinson, formerly General Manager of the Atlantic & Pacific was elected President of the San Antonio & Aransas Pass road last week, to succeed Mr. Uriah Lott, resigned. Mr. Robinson, it will be remembered, resigned from the Atlantic & Pacific last August, and became General Manager of the Aransas Pass road, but resigned in a short time under an agreement by which he was to assume executive control of the road as soon as the receivership was terminated.

—Mr. B. H. Payne has been appointed Assistant General Passenger and Ticket Agent of the St. Louis, Iron Mountain & Southern, succeeding Mr. B. D. Caldwell, who resigned to accept the chairmanship of the Western Passenger Association. Mr. Payne has been Chief Rate Clerk of the Missouri Pacific general passenger department for several years, and he was connected with the Kentucky Central, Cincinnati, Wabash & Michigan, and Queen & Crescent in a similar capacity prior to entering the Missouri Pacific service.

—Mr. F. W. Huidekoper, of Washington, D. C., one of the receivers of the Richmond & Danville appointed by the United States Court at Richmond last week, was formerly Vice-President of the road and he has been President, and at another time Receiver of the Pittsburgh, Shenango & Erie road, of which he is still a Director. Mr. Reuben Foster, of Baltimore, who also became Receiver of the company under the same order, is General Manager of the Baltimore, Chesapeake & Richmond Steamboat Co., which is controlled by the Richmond & Danville.

—Mr. George S. Russell, Treasurer of the Cleveland, Cincinnati, Chicago & St. Louis, has tendered his resignation, to take effect at an early date. He resigns to become the cashier of the new Western Reserve Bank of Cleveland. Nearly all the company's offices have been removed to Cincinnati, and as Mr. Russell desired to remain in Cleveland, that fact had some influence on his decision. Mr. Russell has been with the Bee Line and the Big Four for a number of years, part of the time serving in the capacity of both Secretary and Treasurer.

—Mr. N. W. Eayrs has resigned the position of General Manager of the Wheeling Bridge & Terminal Railway to accept the position of Superintendent of Structure and interlocking of the Terminal Railroad Association of St. Louis. Mr. J. E. Taussig, formerly Freight and Purchasing Agent, has been appointed Superintendent of the Wheeling Bridge & Terminal Co., appointment to take effect on June 20. Mr. Eayrs was formerly Resident Engineer of the Terminal Association, but became General Manager of the Wheeling Terminal system in May, 1891.

—Mr. James L. Taylor, General Passenger Agent of the Richmond & Danville, has resigned to accept a position on another road. W. A. Turk succeeds to the duties of the office, with the title of Assistant General Passenger Agent. Mr. Taylor has been General Passenger Agent of of the road since 1886, and was General Freight and Passenger Agent of the Savannah, Florida & Western between 1877 and 1886. He is one of the most prominent of Southern Passenger Agents. He has been in railroad service since 1867, and has had a varied experience in the traffic departments of several Southern railroads.

—Mr. Emmons Blaine, who died at Chicago, June 18, had been connected with railroading since leaving college. Soon after his graduation he entered the law department of the Chicago & Northwestern, but soon left it to enter the freight department of the same company, and was later appointed Freight Agent in Iowa and then Division Freight Agent, with offices at Chicago. In 1886 he became General Freight Agent of the Chicago, Santa Fe & California. In 1889 he became assistant to the President of the West Virginia Central & Pittsburgh for a short time. Last October he was appointed General Agent of the Baltimore & Ohio road for the West and Northwest, with headquarters at Chicago. Mr. Blaine was born in 1857, and was the second son of the Hon. James G. Blaine.

—Sir James Brunlees died at Argyle Lodge, Wimbledon, on June 2. He was born at Kelso, N. B., in 1816, and was educated at Edinburgh University. In 1838 he became an assistant engineer to Mr. Alexander Adie on the Bolton & Preston Railway. Subsequently, under Sir John Hawkshaw, he was occupied with the works of the Lancashire & Yorkshire Railway. He next constructed the works of the Londonderry & Coleraine Railway, and then the works of the Ulverston & Lancashire Railway. This was about 40 years ago. Since that time he has taken high rank as an engineer, his principal works being the Solway Junction Railway, the Clifton Extension Railway, the Mersey Tunnel Railway, and the Avonmouth, King's Lynn, and Whitehaven Docks, the Sao Paulo Railway, the Minas & Rio Railway, the Porto Alegre Railway, and the Central Uruguay & Bolivar Railway. He was also joint engineer with Sir John Hawkshaw of the proposed Channel tunnel. Sir J. Burnlees was a past-president of the Institution of Civil Engineers.

ELECTIONS AND APPOINTMENTS.

Brooklyn & Brighton Beach.—William Findlay has been appointed Superintendent to succeed the late Col. James Morrow. He has been Master Mechanic of the road for eight years.

Burlington & Northwestern.—The following directors have been elected for this company: L. W. Barhydt, W. W. Baldwin, John T. Remey, Norman Everson, J. W. Blythe, Lyman Cook, C. P. Squares, H. C. Garrett and H. B. Scott. The directors elected officers as follows: President T. W. Barhydt; Vice-President, John T. Remey; Secretary and Treasurer, R. M. Green; Superintendent, John T. Gerry.

Canada Eastern.—At the annual meeting of the directors Alexander Gibson was appointed President and J. B. Snowball Manager. James S. Neil was appointed a director in place of Marshall Richey, deceased.

Central of Georgia.—T. B. Slade has been appointed Roadmaster of the Southwestern Division, with headquarters at Macon, Ga. He was formerly Roadmaster of the South Bound road in South Carolina. S. H. Hill has been appointed Trainmaster of the same division, being transferred from a similar position on the South Carolina Division.

Central Ontario.—J. Lyons Bigger, of Belleville, Ont., has been appointed Assistant General Manager.

George Collins has been appointed Assistant Superintendent, and also Secretary and Treasurer. His headquarters will be at Trenton, Ont.

Chester & Lenoir.—W. H. Hardin, of Chester, S. C., was re-elected president at the recent stockholders' meeting. The road is a narrow gauge 109 miles long and is operated by the Richmond & Danville.

Chicago & Eastern Illinois.—Charles W. Humphrey has been appointed Northwestern Passenger Agent, with headquarters at St. Paul, Minn.

Chicago, Milwaukee & St. Paul.—F. W. Deibert formerly General Foreman at Portage, Wis., has been promoted to be Master Mechanic of the West Milwaukee shops of that road, succeeding E. M. Herr, resigned.

Chicago & Northwestern.—John C. Stuart, who succeeds Otto Miller as Superintendent of the Galena division, has been for several years Assistant Superintendent of the Wisconsin division. Mr. Miller, it is said, will retire from railroading.

Clermont & Marvin Creek.—The following are the incorporators of the company: Thomas C. Wainman, Eldred, Pa., President; Lafayette J. Backer, Boston, Mass.; Clarence A. Backer and A. F. Brown, East Smethport, Pa.

Delaware, Lackawanna & Western.—The five divisions of this road have for some years been in practical charge of Assistant Division Superintendents reporting to Supt. Reasoner and Gen. Manager Hallstead, but a recent order changes the title of these officers to Division Superintendent.

Fairhaven & Southern.—The company held its annual meeting at Fairhaven, Wash., June 15, and elected the following trustees and officers: J. J. Hill, C. X. Larrabee, P. N. Strader, H. Y. Thompson and P. P. Shelby. C. X. Larrabee was re-elected President, P. P. Shelby was chosen Vice-President and General Manager, and H. Y. Thompson was elected Secretary.

Fair Hill.—The incorporation of this company in Pennsylvania was noted last week. It is a Pennsylvania branch, the directors being: J. N. Du Barry, President; Jos. U. Crawford, W. J. Lulta, John B. Stauffer and Henry D. Welsh, all of Philadelphia; Wm. A. Patton, Radnor and N. Parker Shatridge, Wynnwood, Pa.

Great Northern.—H. E. Danz has been appointed General Freight Agent, and G. O. Somers, Assistant General Freight Agent, of the St. Paul, Minneapolis & Manitoba, and Duluth, Watertown & Pacific and Willmar & Sioux Falls roads, with headquarters St. Paul, Minn.

P. Ryan, Assistant Roadmaster at St. Cloud, Minn. has been appointed Division Roadmaster of the Pacific extension. Edward Deviney has been appointed Assistant Roadmaster at St. Cloud, Minn.

Kansas City, Wyandotte & Northwestern.—The following new officers, representing the Missouri Pacific, were elected at a meeting last week: President, George C. Smith; Secretary and Treasurer, W. P. Waggener; Vice-President, David Martin. The new Board of Directors is as follows: George C. Smith, David Martin, W. P. Waggener, J. W. Orr, B. P. Waggener, David Kelso, C. M. Rathburn, J. W. Waggener, E. G. Merriam, George J. Gould, Elijah Robinson, A. H. Calef and Guy Phillips. C. M. Rathburn, Superintendent of the Western Division of the Missouri Pacific, may be Superintendent of the road, which is still nominally under the control of the Receiver.

Kishacoquillas Valley.—The company was chartered last week. The directors are all from Bellaville, Pa., and are: A. W. Campbell, J. P. Getter, J. K. Renno, W. M. Gibbony, J. Y. Zook, Wm. B. McClay, H. S. Wilson, A. Y. Detwiler, John M. Fleming and A. C. Henderson.

Lake Shore & Michigan Southern.—Charles Tunks, who for years has been the foreman of the blacksmith shops at Adrian, Mich., has been promoted to take charge of the car department in this city, at East Toledo and Air Line junction.

Long Island Elevated.—At the annual election of the company this week the following Directors were elected: Austin Corbin, Charles M. Pratt, Benjamin Norton, George S. Edgell, William B. Kendall, William Richardson, Newberg L. Frost, Frederick L. Schroeder, Samuel F. Browne, John G. Jenkins.

Minneapolis, St. Paul & Sault Ste Marie.—At the annual meeting 185,012 shares of the 210,000 shares of stock were represented. The old board, with the exception of F. N. Finney, of Milwaukee, who is succeeded by C. H. Pettit, of Minneapolis, remains unchanged. The directors are: John S. Pillsbury, John Martin, W. C. Van Horne, R. B. Langdon, W. D. Washburn, Thomas Lowry, C. H. Pettit. Thomas Lowry, President; R. B. Langdon, Vice-President; W. L. Martin, Secretary and Treasurer, and F. D. Underwood, General Manager.

Minnesota & Wisconsin.—The following officers have been elected: D. M. Sabin, President; E. D. Buffington, Vice-President; H. C. Truesdale, Secretary and Treasurer; H. P. Breed, General Manager, and E. F. Dodge, Traffic Manager.

Missouri, Kansas & Texas.—Conductor G. Maxwell has been appointed General Baggage Master, with headquarters at Parsons, Kan., vice W. W. Campbell, resigned to accept similar position with the Texas & Pacific.

Montezuma, Trinidad & Western.—J. F. Kern, J. Rosenthal, J. G. Michaels, J. L. Patrick, G. T. Crist, G. T. Beatty and J. B. Gray, all of Santa Fe, Kan.; E. J. Clark, Montezuma, Kan.; George W. Earp and C. W. Nickersham, Ulysses, Kan.; Thomas Cooper, Richfield, Kan., are the directors of this company chartered in Kansas last week.

Nicaraqua Canal Construction Co.—The annual meeting was held at Denver, Col., last week, and with three exceptions the old board was elected. The new members are John W. Mackay, of the Postal Telegraph Cable Co., H. O. Armour, of New York, and A. C. Griscome, of Philadelphia, President of the International Steamship Co. A meeting of the directors will be held in New York to elect officers for the ensuing year.

Ohio Southern.—F. E. Fisher has been appointed Traveling Freight and Passenger Agent of this company. He was formerly General Freight and Passenger Agent of the St. Louis, Alton & Springfield.

Oregon Improvement Co.—At a meeting this week the following were elected directors: W. H. Starbuck, C. B. Ledcastle, A. H. French, M. V. B. Edgerly, C. H. Lewis, Henry Failing, A. M. Ladd, Jonathan Bourne, C. J. Smith. Officers will be elected in July.

Oregon Railway & Navigation Co.—At the annual meeting of the stockholders in Portland, Or., June 20, practically the old board of directors was re-elected. S. S. H. Clark was chosen President in place of Sidney Dillon, deceased.

Oregon & Texas.—The following is a list of the directors who have incorporated this company in Pennsylvania: Charles E. Titman, Shenandoah, President; J. A. Titman, I. M. Titman, S. G. M. Hollospeter, and G. G. Clauser, all of Shenandoah; Daniel Shepp and E. M. B. Shepp, Tamaqua, Pa., and John G. Reading, Williamsport, Pa.

Rock Island & Peoria.—The annual election was held at Rock Island, Ill., June 14, and the directors elected were: R. R. Cable, George W. Cable, and H. B. Sudlow. The directors elected R. R. Cable, President; A. Kimball, Vice-President, and H. B. Sudlow, Secretary and Treasurer.

Rome & Clinton.—At the annual meeting at Rome, N. Y., June 15, the following directors were elected: J. I. Scollard, B. J. Beach, W. H. Tuller, F. A. Elliott, C. H. Smyth, E. Stebbins, D. N. Crouse, F. R. Miller, Clinton Scollard, W. H. Van Wagenen, W. W. Parry, H. D. Spencer, C. D. Hayes. Dr. J. I. Scollard was elected President.

Richmond & Danville.—F. W. Huidekoper, of Washington, D. C., and Reuben Foster, of Baltimore, have been appointed Receivers of this company, and they have re-appointed the present general officers. The general offices, which have been at Atlanta, Ga., for the last year, have been moved back to Washington, D. C.

St. Joseph & Grand Island.—At the annual meeting S. H. H. Clark was chosen a director in place of the late Sidney Dillon, and F. Gordon Dexter was chosen to fill a vacancy. There were no other changes.

St. Louis, Keokuk & Western.—The announcement is made of the appointment of S. E. Crance as General Superintendent of the St. Louis, Keokuk & Northwestern; Chicago, Burlington & Kansas City, and the eastern division of the Hannibal & St. Joseph, in place of C. M. Levey, promoted to be Superintendent of the Iowa division.

St Paul & Duluth.—W. A. Russell has been appointed Assistant General Passenger Agent, vice G. C. Gilfillan, resigned.

San Francisco & Atlantic.—The names and addresses of the incorporators are as follows: Frederick Home and A. Judson, of San Francisco; Lyman C. Park, of Oakland; Green Majors, of Alameda, Cal., and R. T. Harding.

Seattle & Montana.—P. P. Shelby, late General Traffic Manager of the Great Northern, has been appointed General Manager of the Seattle & Montana, with headquarters at Seattle, Wash. He will also have control of the Fairhaven & Southern and New Westminster Southern road.

Vermont Valley.—The annual meeting was held at Brattleboro, Vt., June 15, and the following board of directors chosen: Oscar Edwards, of Northampton; John Mulligan, of Springfield, Mass.; Hugh Henry, of Chester, Vt.; J. H. Albin, of Concord, N. H.; H. E. Folsom, of Lyndonville, and J. H. Williams, of Bellows Falls. Messrs. Mulligan and Albin are new members.

Weatherford, Mineral Wells & Northwestern.—At a meeting of the directors, held at the office of the company at Weatherford, Tex., June 14, immediately after the adjournment of the stockholders' meeting, L. M. Fouts, formerly General Manager, was elected President; E. R. Standish, Treasurer, and A. F. McKay, Secretary.

Williams Valley.—The following is a list of the present officers of this company: President, Carroll R. Williams, 608 Chestnut street, Philadelphia, Pa.; Treasurer, Dr. E. F. Philips; Secretary, M. Kauffman, and Chief Engineer, Hammond Carr, all of Tower City, Schuylkill County, Pa.

York Springs & Dillsburg.—The first board of directors is as follows: President, T. G. Neely, of York Springs, Pa., and E. W. Cashner, D. N. Stewart, C. E. Meyers, J. W. Pearson, Jr., H. B. Pearson, A. Grove, J. B. Meyers and Andrew Deurdorff, all of York Springs, Pa.

RAILROAD CONSTRUCTION.
Incorporations, Surveys, Etc.

Astoria & Portland.—Work on the road is reported to be progressing rapidly. The contractors have completed one and one-half miles of trestle, commencing at the water front at Astoria, Or., and running around Sand Point, extending out across Young's River. There are now 1,500 men at work. The approaches to the tunnel near Saddle Mountain have been completed. The projectors are confident that the road will be completed as far as Hillsboro within one year. Rails will soon be received, and laid as fast as the roadbed is finished. Rolling stock has already been ordered. George Goss, of Astoria, is Superintendent of Construction. The New York office is at 33 Broadway.

Beech Creek.—The local papers are always ready to give the impression that this road is an active one in the field of railroad construction, even if their speculations are never verified. The last reports are that surveys are being made from a point east of Clearfield south through Houtzdale and thence toward Altoona. Even if the first part of this report is true, it is not likely that the line will be continued to Altoona.

Bellaire, Zanesville & Cincinnati.—The report that part of this line is to be changed from narrow gauge is confirmed. The company is now making the location for some 40 or 50 miles of new line with a view to making that portion of the present line a standard guage road.

Bellefonte Central.—The right of way is reported to have been secured for a line south of Bellefonte, Pa., for an extension to Mill Hall, and that the line will be built in connection with some extensions of the Beech Creek. This report may be correct, but it will not be out of place to add that President R. Frazer wrote to us in May, when the road was completed to State College, that no other extension would be built this year.

Bloomsburg Belt.—The section of this road now being built by the Philadelphia & Reading, about 1.7 miles long and will be completed by July 1. The projected length of the line is 2.34 miles long.

British Columbia Southern.—The bill which sought to give this company power to connect with the American roads has been withdrawn from the Dominion parliament at the request of the Government for the same reason as that assigned for the withdrawal of the Nelson & Fort Sheppard bill, viz., that the Kootenay Valley should be reserved for the Canadian Pacific.

Buffalo & Geneva.—Every effort is being made to have the line between Buffalo and Geneva, N. Y., ready for operation by July 1. A considerable amount of work will still remain to be finished after that time. A large force is now working on the tracklaying and ballasting that still remains to be done. Chief Engineer King gives the following account of the work in an interview in a local paper: The heavy rains we have had this spring, especially within the past few weeks, have kept us back. The Buffalo end is in good shape for through service, and our principal trouble is with the line between Geneva and Van Ettenville. The grading on the Van Ettenville end will be completed by the middle of July. We have 29 miles of single track laid from Geneva south and 24 miles from Van Ettenville north, leaving a gap of 11 miles on which grading is finished with the exception of a few heavy fills. The masonry is all finished, and the the double track is already laid for 10 miles. The opening of the road will not be dependent on the completion of our new line between Geneva and Van Ettenville. We already have a line passing through the territory, but it cannot give the service it is intended to get by the new route. From Geneva to Buffalo the road is in shape to care for the heaviest traffic.

Canada Northern.—There appears to be every prospect, writes a Canadian correspondent, that the survey for this road will start shortly. A syndicate has offered to deposit $200,000 with the government as a guarantee that the work will be carried out. The road is projected from a point in British Columbia through the mountains by way of Pine River pass, just south of the Peace River valley, crossing the southern part of Athabasca, into the North Saskatchewan valley near Edmonton.

Canadian Pacific.—Thos. White, engineer in charge of the extension through the Pipestone district in Manitoba states that the road has been graded to within a short distance of Oxbow, and work will be finished in 10 days. The tracklaying forces are up with the grading and the work is being rushed through with all possible speed. In ten days the road will be ready for opening. This branch begins at Hartney, Man. The road to the Souris coal fields in Southeastern Assiniboia will be finished in about a month, and Winnipeg will then have an abundant supply of cheap coal.

J. G. Dennison, contractor, has several hundred men at work on his contract to finish the Glenboro extension between Souris and Nesbit, Man. This is a gap of 18 miles, and in six weeks it is expected the work will be finished. Charles Wellman, who has 11 miles from Deloraine to Napinka, Man., yet to finish, will complete the work shortly.

General Superintendent Whyte is now en route to the Souris district, in Assiniboia, and while there will locate the terminal point of the branch line, and also probably the point of the junction with the extension of the Soo line to Regina. The grading of the Souris extension is nearly completed, and the tracklaying is also nearly up to the end of the grade.

Cerrillos Coal.—The road at Cerrillos, N. Mex., south of Santa Fe, is being built by the Cerrillos Coal Railroad Company. It is but a short line, extending from a connection with the Atchison, Topeka & Santa Fe road at Waldo Station to the mines owned by the Cerrillos Coal & Iron Co. At present there are about six miles of main track and four miles of branch lines and spur tracks being constructed. Hon. R. C. Kerens, of St. Louis, is President of the road, and James Dun, of Topeka, is the Chief Engineer. The road will be operated by the Atchison.

Chattanooga Southern.—It is reported that a survey has been commenced by this company for a line through East Tennessee to connect with the Marietta & North Georgia about 50 miles east of Chattanooga. One of the advantages claimed for this line is that it would shorten the distance between Chattanooga and Knoxville 12

miles over the East Tennessee road, but this is not the best reason that could be advanced for building a line through these mountains.

Newman Erb and E. Summerfield, representing the majority of the bondholders, are reported to have under consideration a plan for the extension of the line south of Gadsden, Ala., toward Birmingham. The presence of these gentlemen in Birmingham last week gave rise to a report that they were then investigating the best route for an entrance into that city.

Chicago, Rock Island & Pacific.—The grading on the extension being built through the Indian Territory is reported to have been completed to Marlow, leaving 50 miles to be completed to reach the North State Line of Texas. The locating surveys have reached Bowie, Tex., about 120 miles south of Minco, Ind. Ter., and several preliminary surveys have been made south of that point; but if the route beyond Bowie has been decided upon by the officers, no description of it has been given to the local papers. The track has been laid for over 50 miles, and trains have been running since May for 20 miles south of Minco to Chickasha, which is said to already have a population of nearly 1,000.

Clearfield & Mahoning.—The contracts have been let for the grading of this connecting line, as noted last week. The contractors are George S. Good & Co., of Lockhaven, Pa., now at Clearfield, Pa.; Capt. John Shield, Flemington, N. J.; Thomas Collins, Havana, N. Y., and Calvin E. Broadhead, Caledonia, N. Y. Good & Co. have 16 miles from Clearfield. The road is to be built from near Du Bois east to Clearfield, Pa., to connect the Buffalo, Rochester & Pittsburgh with the Beech Creek road, and it is to be about 27 miles long. The route is from Clearfield, Pa., through Curwensville, Bridgeport, Luthersburgh to Jefferson line on the Buffalo, Rochester & Pittsburgh. The grading has just begun, 500 or 600 men being now at work. The grading is heavy, through a mountainous country, with a large percentage of rock work. The grades will be light and the curvature easy. Three large spans of iron or steel bridges across the Susquehanna will be necessary, and a long steel viaduct at Curwensville. W. E. Hoyt, of Rochester, N. Y., is Consulting Engineer, and J. M. Floesch, of Clearfield, is Chief Engineer.

Colorado Midland.—What it is expected will be the locating survey for the Cripple Creek branch is now being made, and will soon be finished. This is the third survey which has been made for the branch, which will probably extend from Hayden, Col., north 18 miles to the mines at Cripple Creek.

Columbus, Lima & Milwaukee.—The suit of B. C. Faurot, ex-President of the company, for a temporary injunction restraining the new board of directors from carrying out their contract with F. C. Helm for the construction of the road, was decided at Lima, O., June 20, the injunction being refused. The road will now be built rapidly, it is reported. Surveyors have left Columbus to go over the line. It is also stated that the section between Lima and Defiance will be completed within 90 days. Hon. Hylas Sabine, of Marysville, O., ex-Commissioner of Railroads, is now President of the company.

Concord & Montreal.—The directors seem to have finally decided to authorize the construction of the new Exeter & Amesbury branch. At a meeting on June 18, it was voted to submit to the stockholders a proposed agreement for a long lease of the line, at an annual rental of $20,000. The construction of the line between Epping and Exeter, N. H., eight miles, will be undertaken by the local company at Exeter and taken over by the Concord & Montreal, when the construction has been approved by its engineers.

Duluth, South Shore & Atlantic.—The company has been compelled to abandon the Northern Pacific tracks from Iron River to Duluth and has arranged with the St. Paul & Duluth and Chicago, St. Paul, Minneapolis & Omaha to West Superior and over the Omaha to Superior.

Eagle's Mere.—The construction work on this line is now so far advanced that the officers state that the road will certainly be opened for traffic by July, as announced in these columns in April, when the grading was begun. The road is a narrow gauge line, seven miles long, from Sonestown on the Williamsport & North Branch north to Eagle's Mere Pa.

East & West of Georgia.—R. M. Mitchell, who built the Augusta, Gibson & Sandersville, is now President of this new Georgia road, with headquarters in Sparta. The road is chartered to build from Sparta to a point on the Central of Georgia to the state line near Chattanooga, passing through Sparta and Hancock.

Fair Hill.—The ordinance to grant this company right of way along the streets of the city failed to pass the Philadelphia councils last week. As stated last week, the line was projected as a freight branch of the Pennsylvania, one mile along over its own property from Ormes street to Cambria street. The objection made to the ordinance was that it would create new grade crossings.

Grand Trunk.—The contract for the earthwork on the Glencoe and Kingscourt line has been awarded to John Ross, Toronto; the two iron bridges to the Hamilton Bridge Co., and the masonry to William Gibson, Beamsville. The line is to be built from Glencoe, north to Kingscourt, Ont., a distance of about 22 miles. It is a loop line, Glencoe being on the Detroit line and Kingscourt on the Sarnia line.

Great Northern.—The contract for rebuilding the line from Cassalton to Mayville, S. D., has been awarded to Foley, Grant & Guthrie, of St. Paul. The old rails and ties will be taken up and the line graded, making practically a new road bed, with heavier rails and new ties. The contract includes 43 miles of main line and seven miles of sidings. When this line is rebuilt the company will have two lines from St. Paul west of the Red River.

F. E. Parker, Superintendent for Shepard, Henry & Co., is reported to have said that about 2,000 men are at work on the west side of the mountains. The grading is finished to Granite Point, 33 miles from Snohomish, and tracklaying will begin in August. The small tunnels are nearly all finished, and work on the switchback will begin in about two weeks. W. P. Watson, Assistant Engineer, says that the grading is nearly finished between Spokane and the Columbia River, only a little rock work remaining to be done. The location of the bridge over the Columbia River will be about nine miles below Wenatchee. The bridge will be a steel cantilever, with a 423 ft. span from the east side to a natural rock in the river, and another 170-ft. span to the west side. Between 700 and 800 men are at work between Wenatchee and the summit of the Cascades. J. W. Tompkins is the principal assistant engineer at Wenatchee, Wash.

Houston & Texas Central.—Receiver Dillingham met by appointment at Bryan, Tex., last week a committee of the local Board of Trade, who urged the building of a line down the Brazos River from Bryan. The conference does not seem to have resulted in any definite decision being arrived at. Another line which the Receiver has been asked to build is one from McNeil via Round Rock and Georgetown to Granger.

Johnsonburg & Bradford.—The tracklaying will probably begin Aug. 15, and the branch will be completed between Howard Junction and Mt. Jewett, Pa., 20 miles, in October. The contractors have about 1,000 men now at work.

Kansas City, Nevada & Fort Smith.—General Manager Gentry announces that the engineers will begin the survey next week for the line south of the present terminus at Hume, Mo., toward Pittsburgh, Kan. Surveys were made last year for the northern section of this line, and Mr. Gentry says the grading will begin as soon as the engineers have located a few miles. Ties and rails for a portion of the line have already been purchased. The line will possibly be built to a point near Joplin, to which point the surveys have already been made.

Kishacoquillas.—The route of this road which, as noted last week, has just been chartered is from Belleville, Pa., northeast to Reedsville in Mifflin County, where it will connect with the Pennsylvania. The grading will be easy, the route being through the valley between the Standing Stone and Jacks mountains. The maximum grade is 1¾ per cent., and the only bridge on the line will be 100 ft. long. The distance is nine miles, and will be through an agricultural district. The officers report that about two-thirds of the money needed to construct the line has already been raised. Samuel Watts, of Belleville, is President.

La Porte, Houston & Northern.—Maj. C. G. Woodbridge, Chief Engineer, writes that about 100 men have been at work on the grading for the last month under J. F. Allen, of Lincoln, Neb., to whom the contract was let on June 1. The work is very light, the maximum grades being 26 ft. to the mile, and there is only one iron bridge. This is across Buffalo Bayou, and is about 225 ft. long. The road has been located from La Porte to Houston, Tex., a distance of about 20 miles, and will connect at Houston with the Southern Pacific System. A line is projected from La Porte east to Sabine Pass, Tex., about 113 miles, but no work has yet been done on it. The road is being built by the Interior Land and Emigration Co., which is also improving the Harbor at La Porte. Colonel A. M. York is President of the company.

Little Falls & Dolgeville.—Tracklaying has just been commenced on this road at Little Falls, N. Y. The bridge work and the grading at several deep cuts has delayed this work considerably. It is now expected that construction trains will be put on by June 23, and that the road will be fully completed by Sept. 1. The route will extend from Little Falls, N. Y., on the New York Central & Hudson River road northeast to Dolgeville, a distance of about 11 miles. C. R. Eastman, of Little Falls, is Superintendent.

Mason City & Fort Dodge.—The proposed extension north of Mason City now stands about this way: Mr. Hamilton Browne, who built this road, is preparing estimates at the request of the citizens of Mason City, Ia., for a line between Mason City and Manly Junction, nine miles, which would connect the Chicago, St. Paul & Kansas City with Mason City. This is as far as the project has got so far.

General Manager Burdick writes to us denying the statements in a recent Sioux City press dispatch, in which he was credited with stating that his road would soon be merged with the Chicago, St. Paul & Kansas City, and that a line would be built across the state to Council Bluffs. Mr. Burdick says the report is wholly without foundation. The statements were printed in a number of papers, including a Chicago railroad newspaper.

Macon & Dublin.—About 100 men are now grading the two miles of track necessary to bring the road into the city of Macon, Ga., to connect with the various railroads, and the contract has been let for the bridge across the Ocmulgee River. Trains will probably be running over the new line in 60 days.

Memphis & Yazoo City.—This company, recently incorporated in Missouri to build a road from Yazoo City to Memphis, has the following incorporators: John Clark, Clarksdale, Miss.; Chester H. Pond, Moorehead, Miss.; Geo. Prentiss, Moorehead, Miss., and T. Schmitt, Yazoo City, Miss. The office of the company will be at Yazoo City.

Missouri Pacific.—The new Plattsmouth line of the Omaha Southern which was built last year has only recently been put in operation. Trains run from Omaha over the new bridge across Platte River to Union, Neb. The road is 26 miles long from Union to Gilmore.

Montezuma, Trinidad & Western.—This company was chartered in Kansas last week by the directors whose names are given in another column. The capital stock is $250,000, and the principal office is to be at Santa Fe, Haskell County, Kan. The route is not given, but the line is probably an extension of the Dodge City, Montezuma & Trinidad, which is now in operation to Montezuma, Kan.

Montreal & Occidental.—The opening of this road will take place July 1. The line extends from St. Jerome, Que., where it connects with the Canadian Pacific northward to St. Agatha, from whence it touches St. Jovite to the west. The route proposed is thence north to Iroquois Falls, 70 miles from St. Jerome, and the line then turns to the west to cross the upper part of the valley of the Ontario.

Natchitoches.—President Caspari states that the work will begin early in July on the extension north of Natchitoches to the Red River, about five miles. It is also proposed to continue the line north of the Red River this year.

Nebraska Central.—Douglas County, Neb., in which Omaha is situated, voted on June 16 in favor of a bonus of $750,000 to aid the company to build a bridge over the Missouri River, a union station and terminals in Omaha, and connecting lines in Iowa, to provide an entrance into Omaha for various roads.

New Roads.—A Bangor paper states that a preliminary survey is soon to be made for the proposed road from Camden to Ellsworth, Me., via Augusta. The road, it is believed, can be built for $11,000 a mile. The towns along the proposed route between Augusta and Camden are without railroad facilities, and, it is claimed, will vote bonuses.

Judge H. Ward Hicks of Monett, Mo., told a reporter of a St. Louis paper last week that with A. J. Grayson of Monett, he was securing right of way from Monett southeast across Arkansas to Bald Knob, a distance of about 200 miles. Judge Hicks says that the route is through a rich mineral and timber country. The right of way is being secured at the instance of a committee of citizens of Monett, but he says $200,000 has been subscribed in St. Louis for the line, and he is assured of other aid from Kansas City, Memphis and Springfield; and of course he will not fail to ask the towns along the route to grant a considerable bonus.

A new project for a road in southern New Jersey, to be built by stock subscription from the towns along the route, has come to light. John C. Bullet and Thomas Robb, of Philadelphia, are reported to be the projectors of this line, which it is proposed to build from Landisville, Cumberland County, on the New Jersey Southern, south along the shore of Delaware Bay to Cape May, N. J., a distance of, say, 75 miles.

The town of Calvert, Tex., threatens to do a little railroad construction on its own account. A subscription of over $50,000 was raised for an extension of the Hearne & Brazos Valley road to Calvert. But as the company could not be induced to build even for $50,000, the town now proposes to build on its own responsibility to Hearne to connect with the International & Great Northern.

Norfolk & Western.—The work of double tracking the road from Norfolk to Lambert's Point, 4½ miles, has been fully completed.

The branch line to the West Roanoke Iron Co.'s iron mines at Kingston, near Christiansburg, Va., has just been completed. It is stated that the ore is a good brown hematite, running over 50 per cent. in metallic iron.

Northern Pacific.—The Gray's harbor branch has been opened to business from Elma, Wash., to Slater's mill, with the stations at Springer's mill, 3 miles from Elma, Quimby's mill, 5 miles, and Slater's mill, 8 miles.

Oregon & Texas.—The charter of this company was filed in Pennsylvania last week. The road is to be built from Cammal Station on the Pine Creek road, one of the Fall Brook Coal Co.'s lines, to Silver Springs, in McHenry township, Lycoming County, a distance of about eight miles. The capital stock is $80,000. The road was noticed last week as the Texas & Oregon. Charles E. Titman, Shenandoah, Pa., is President.

Ottawa & Gatineau Valley.—About 350 men are at present engaged on the fourth section of the road north of Wakefield, Que. Tracklaying will be commenced in a couple of weeks and it is expected to have the section ready for traffic in the fall.

Pennsylvania.—The Pennsylvania Schuylkill Valley division has completed surveys for a bridge over the Schuylkill River at Spring City, Pa., in order to reach Royersford, from which the Reading has a heavy traffic. The branch will be something over a mile long, and with the three-span bridge will, it is estimated, cost $110,000. The line was erroneously referred to last week under the Philadelphia & Reading. Right of way has been secured through Royersford, and 100 men are at work on the grading.

San Francisco & Atlantic.—Articles of incorporation have been filed by this company. The route is from San Francisco to Los Angeles, through Alameda, Contra Costa, San Joaquin, Stanislaus, Merced, Fresno, Tulare, Kern and Los Angeles counties, an estimated length of 500 miles. The capital stock is $20,000,000, of which $500,000 has been subscribed. The route from Oakland to Stockton is along the east side of the San Joaquin Valley. The company has acquired the surveys made a few years ago by the Stockton, Fresno & Southern.

Santa Fe & Santa Monica.—This line was opened to Santa Monica, Cal., on June 18. It is a branch of the Southern California, five miles long, beginning at a point on its Redondo line, and extending northwest to Santa Monica, a seaside resort.

Siuslaw & Eastern.—The subsidy of $100,000 asked for by the company to construct a road from Eugene to Florence, Ore., has been nearly all subscribed, it is reported. Work will begin as soon as the total amount has been raised.

Southern Pacific.—The Collis branch has been completed from Fresno to Collis, Cal., 14 miles. After July 1 through trains on the main line will pass over the Collis branch via the Westside road and Tracy.

Spokane Terminal.—The committee of Spokane citizens, which has this project in charge, is arranging for another meeting with the representatives of the railroads to discuss the plans. The meeting on May 25 was adjourned because no representative of the Great Northern was present. The object of the Terminal committee is to construct a system of tracks to the milling and manufacturing centre of the city, which should accommodate not only the present but also prospective industries. These tracks are to be a part of a transfer system connecting with all the lines entering the city. The proposition made by the Terminal committee is that it will procure all the right of way necessary for this system if the railroads will combine and build and operate it jointly, without making a switching charge to or from any mill or factory. E. J. Roberts, of Spokane, Wash., is Chief Engineer for the committee.

Victoria & Aberdeen.—The committee appointed to secure the right of way into Aberdeen, Wash., for the road on the north side of the Chehalis River has secured the land for a good part of the distance on the east side of the Wiskah River.

West Virginia & Pittsburgh.—An indefinite report is printed that the company has the financial arrangements for completing the line to Covington, Va., well under way and will probably have the matter completed in a few months. The line is to begin at the Gauley River and connect near Covington with a branch of the Chesapeake & Ohio now being built, but no effort will be made to complete the line this year.

Yankton, Norfolk & Southwestern.—M. W. Sarton, of Allegan, Mich., the contractor who is reported so have undertaken to build this road, went over the line last week, with Norman W. Gifford, one of the projectors, from Yankton, S. D., to Norfolk, Neb. What the outcome of the trip will be is not yet known.

York Springs & Dillsburg.—This company was incorporated in Pennsylvania, June 21, to build a line from the Borough of York Springs, in Adams County, to Dillsburg, nine miles. The capital stock is $100,000. Thomas G. Neely, York Springs, Pa., President.

GENERAL RAILROAD NEWS.

Baltimore & Ohio.—The financial statement for May shows: Gross earnings, $2,018,780, an increase of $53,421 compared with the same month of 1891; operating expenses, $1,498,871, an increase of $95,341, and net earnings, $519,909, a decrease of $41,920. For the eight months ending May 31, 1892, the gross earnings were $16,742,506, an increase of $1,125,807 compared with the corresponding period of the previous fiscal year; operating expenses, $12,347,095, an increase of $1,261,747, and net earnings $4,395,411, a decrease of $135,850.

Brantford, Waterloo & Lake Erie.—A special meeting will be held at Brantford, Ont., July 22, for the purpose of considering an amalgamation of the company with the proposed Toronto, Hamilton & Buffalo road.

Camden & Alexandria.—The formal notice of the sale of this road to the St. Louis, Iron Mountain & Southern, which was ratified by that company's stockholders on May 27, was filed at Little Rock on June 16. The road was built in 1891 from Camden to Eldorado, Ark., 32 miles.

Central New England & Western.—The bondholders' committee has succeeded in getting every bondholder to consent to the reorganization plan. The property will be turned over to the Philadelphia & Reading without further delay.

Chicago Great Western.—At the special meeting at Chicago, June 21, of the stockholders of this company, the lessee of the Chicago, St. Paul & Kansas City road, the proposition to increase the capital stock from $90,000,000 to $100,000,000 was carried. Chairman Stickney's report was approved. The proceeds from the sale of the additional stock will be used in improving the road and in buying new equipment.

Chicago & Southeastern (Ind.).—D. A. Rice has been appointed Receiver in the suit brought in the Boone County Circuit Court recently by local creditors. The suit was removed to Marion County, and the Receiver was appointed by Judge Brown, of Indianapolis. This road was formerly called the Midland (Ind.).

Chelsea Beach.—The directors voted last week to consolidate with the Boston & Maine, under the provisions of the act of 1891. The authorized capital stock of the company is $91,000, of which $38,300 is issued and in the Boston & Maine treasury and the balance is to be issued to the Boston & Maine in payment for work done. The road is about three miles long.

Cincinnati, Jackson & Mackinaw.—The special meeting of the stockholders of the Cincinnati, Hamilton & Dayton to ratify the lease of this road will be held at Cincinnati on July 18. A mortgage in favor of the Central Trust Co., of New York, was filed at Cincinnati last week. This is to secure new four per cent. bonds amounting to $4,800,000 which have been guaranteed by the Cincinnati, Hamilton & Dayton.

Cincinnati, Lebanon & Northern.—So many statements have been published of a probable lease or change of management of this company that a correct statement will probably be welcomed. The report that the Cincinnati, Jackson & Mackinaw had arranged for a lease of the line probably arose from the fact that the officers of that company have been for years periodically examining the property and talking of a lease. The report of a lease to the Dayton, Lebanon & Cincinnati has this much truth in it; that company has been granted the use of the six miles of road between Lebanon and Dodds, so that its trains can run into Lebanon, where it expects to connect with the Lebanon and Northern. The Dayton, Lebanon & Cincinnati proposes to build a standard guage line between Dayton & Lebanon, but at present the line does not run to Dayton. Until the company builds into that city the officers state that it is their intention to run trains into Lebanon from the Centreville stone quarries, located about half way between Lebanon and Dayton.

Kanona & Prattsburg.—A. E. Godefiroy has been appointed Receiver by Hon. William Rumsey on petition of the Farmers' Loan & Trust Co., of New York, trustee for the bondholders.

Louisville, New Orleans & Texas.—The purchase of this property by the Illinois Central was ratified at a special meeting of the stockholders of the latter company at Chicago, June 18. Mr. Fish explains that the fixed charges will be $1,050,000, or a little over 28 per cent. of last year's earnings. He said that the purchase would avoid destructive parallelism, as the company threatened to build into the territory of the Illinois Central. Some traffic will now be diverted to the Illinois Central from the Chicago & Eastern Illinois and the Cleveland, Cincinnati, Chicago & St. East Louis, which have been the company's Northern connections.

Philadelphia & Reading.—The company has just completed the purchase of a large tract on the Delaware River front, giving it possession of nine additional piers on the South Wharves and a number of large warehouses in the rear. The company will pay for the property by an issue of nearly $2,000,000 of five per cent. purchase money mortgage bonds. The company has rented the greater portion of the property for some time past.

Richmond & Danville.—By order of Judge Bond, of the United States Circuit Court for the Eastern District of Virginia, the company was placed in the hands of receivers on June 17. The order of Judge Bond was made upon the application of William P. Clyde, J. C. Maben and William H. Goadby. The receivers appointed are F. W. Huidekoper and Reuben Foster. The order will be reviewed at a hearing at Richmond on Aug. 17. The suit for the appointment of the receivers is a friendly one, and the order will not interfere with any plan for reorganization which may be formed, and will protect the interests of the company in various ways. In a statement issued explaining the reasons for taking this action it was said that the company was in an embarrassed financial condition, threatened with disintegration, and that this condition was aggravated by the orders of the United States District Court at Macon, which had placed the Central of Georgia into the control of receivers not in harmony with the Richmond & Danville, and it seemed likely that the same court would appoint a receiver for the Richmond & Danville. The orders of that court in regard to the stock of the New England Steamship Co. are also reviewed.

Richmond & West Point Terminal Railway & Warehouse Co.—Judge Addison Brown, of the United States Circuit Court, has appointed W. G. Oakman Receiver of the company. This appointment was made on the application of Messrs. W. P. Clyde, J. C. Maben, W. H. Goadby, H. C. Fahnestock, J. A. Rutherfurd, Walter Rutherfurd, Gouverneur Morris, F. W. Huidekoper and Reuben Foster, the last two being Receivers of the Richmond & Danville. The complaint sets forth the well known insolvency of the company, and, as additional cause for the intervention of the court, recites the confessions of judgment recorded in favor of several creditors who were subscribers to the "emergency loan" of $600,000 which is past due. There is no money with which to pay the interest due on the bonds on Aug. 1 and Sept. 1, and they will be defaulted; and the property is likewise liable upon more than $5,000,000 floating debt, some of which is past due, and most of which will be presently defaulted.

San Antonio & Aransas Pass.—The United States District Court at Galveston, Tex., issued an order on June 16, practically terminating the receivership, and transferring the control of the road to the bondholders, who have agreed to pay immediately all claims against the road that have been adjudicated. The receivers have until Oct. 1 to make their final reports.

Union Pacific.—The following statement shows the earnings for April and the year to April 30, for the entire system, and for various of the sub-divisions:

UNION PACIFIC, DENVER & GULF.

	1892.	1891.	Inc. or dec.
April.			
Gross earnings	$417,442	$388,077	D. $29,365
Oper. expenses	359,075	325,025	D. 34,050
Net earnings	$58,367	$63,052	I. $4,685
Mileage	1,453	1,452	D. 1
Since Jan. 1.			
Gross earnings	$1,688,226	$1,537,503	D. $150,723
Oper. expenses	1,426,270	1,302,095	D. 124,174
Net earnings	$261,956	$235,407	D. $26,549

OREGON SHORT LINE & UTAH NORTHERN.

April.			
Gross earnings	$553,237	$629,105	D. $75,867
Oper. expenses	371,856	393,618	D. 22,762
Surplus	$182,381	$235,486	D. $53,105
Mileage	1,424	1,421	I. 3
Since Jan. 1.			
Gross earnings	$2,041,133	$2,423,019	D. $381,885
Oper. expenses	1,367,163	1,475,043	D. 107,880
Net earnings	$673,970	$947,975	$274,005

UNION PACIFIC SYSTEM PROPER.

April.			
Gross earnings	$3,083,835	$3,233,867	D. $151,982
Oper. expenses	2,202,811	2,324,933	D. 122,122
Net earnings	$881,074	$913,934	D. $32,860
Mileage	7,671	7,668	I. 3
Since Jan. 1.			
Gross earnings	$12,060,309	$12,123,735	D. $63,336
Oper. expenses	8,483,707	8,513,900	D. 30,193
Net earnings	$3,576,602	$3,609,835	D. $33,173

GRAND TOTAL UNION PACIFIC SYSTEM.

April.			
Gross earnings	$3,218,241	$3,325,810	D. $107,569
Oper. expenses	2,302,036	2,400,891	D. 98,855
Net earnings	$916,205	$924,919	D. $8,714
Mileage	8,147	8,143	I. 4
Since Jan. 1.			
Gross earnings	$12,656,945	$12,498,196	I. $163,749
Oper. expenses	8,879,280	8,865,445	I. 13,834
Net earnings	$3,777,665	$3,627,750	I. $149,914

Valley (Ohio).—The semi-annual interest on the seven per cent. first mortgage bonds due June 14 has not been paid. The amount of the issue is $1,600,000, and the first mortgage is a lien on the road from Cleveland to Canton, O., 59 miles. The road was purchased Jan. 9, 1890, by the Baltimore & Ohio, but that company has not guaranteed the bonds. At a recent meeting of the Board of Directors of the company a committee, consisting of Gen. Lewis Fitzgerald, Frederick P. Olcott, James Sloan, Jr., George de B. Keim, and Edward R. Bacon, was appointed to prepare a plan for the reorganization of the company. The bonds will be refunded at a lower rate of interest and new securities issued.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, June 22, 1892.

The Western Passenger Association has elected B. D. Caldwell, Assistant General Passenger Agent of the Missouri Pacific, as Chairman, and he has accepted and enters upon the discharge of the duties of the position to-day. He is well spoken of, and although a comparatively young man his friends predict that he will make a good chairman. He began railroading in the auditor's office of the Vandalia, from which road he resigned to take the position of Chief Clerk in the passenger department of the Missouri Pacific, and in 1888 was promoted to assistant general passenger agent. The roads in the association were agreed upon either W. F. White, Passenger Traffic Manager of the Atchison, or M. C. Markham, Assistant Traffic Manager of the Illinois Central, but Mr. White did not want the place and President Fish was unwilling to let Mr. Markham go, so it was not offered to him. By vote of the Advisory Board the new chairman is also a member of the Board of Commissioners of the Western Traffic Association.

Considerable friction has been caused among the western lines by the action of the Rock Island in reducing the rates on bullion eastward and on all freight westbound from the Missouri river to Colorado points. Some of the Rock Island's competitors are likely to keep a sharp lookout for a chance to get even.

The Wisconsin Central has given notice that it proposes to meet the cuts of the "Soo" line from Minneapolis to New York, and the other St. Paul-Chicago lines have been granted the same relief. The "Soo" alleges as a reason for making the cut that the St. Paul market was flooded with return portions of convention tickets.

The action of the Lake Shore in reducing eastbound rates on hogs and provisions 5 cents per 100 lbs., or to a basis of 25 cents on hogs and 30 cents on provisions, Chicago to New York, is severely criticised by many of the other lines, who are of the opinion that the reduction was unwarranted on the pretext made by the Lake Shore, which was that some of its competitors were cutting. But whatever may be the reason, the Lake Shore secured only 8.9 per cent. of the provisions shipped for the six weeks ending June 9 and only 6.3 per cent. for the week ending June 16, and its proportion of the live hog traffic shows about the same ratio. It is too early to determine whether or not the reduction will bring the business to the Lake Shore road.

It is stated that the Big Four is not paying any commissions on passenger business and is trying to get its competitors to again take the same position.

The action of the stockholders of the Illinois Central in ratifying the proposed purchase of the Louisville, New Orleans & Texas is looked upon as wise. The acquisition of this traffic by the Illinois Central will well repay the investment.

The Commissioners of the Western Traffic Association have disallowed an appeal of the St. Louis, Keokuk & Northwestern in regard to meeting boat competition on the Mississippi River, on the ground that the matter was not properly before them for action under the agreement. The appeal came from the Western Freight Association, where some of the lines desired to meet this competition, as had been done in past years, but one of the all-rail lines objected.

The negotiations which have been pending between Chairman Midgley of the Western Freight Association and the Canadian Pacific, in regard to the question of differentials from interior New York points to the Northwest via the "Soo" as compared with the lines via Chicago, have been brought to an end by the demand of the Canadian Pacific for a differential of nine cents on first class, graded to three cents on sixth class. Upon receipt of this demand Chairman Midgley wrote a spicy letter to the Canadian Pacific people expressing regret that, after having led the western lines to expect that consideration would be given to the proposition to withdraw all rates on a differential basis from that territory, they should submit a proposition so extreme as to hardly warrant serious consideration and advising them that the western lines are not at the mercy of the Canadian Pacific and do not recognize its right to say on what comparative basis they shall solicit business wholly within the United States.

The next meeting of the Advisory Board of the Western Traffic Association has been called for July 12 at the Windsor Hotel, New York.

As a result of the demands of the Rock Island and the Wabash the Commissioners of the Western Traffic Association have ordered the Burlington, the Missouri Pacific and the Atchison to make large diversions of the freight to the complaining roads. There is considerable speculation as to whether these orders will be obeyed. There are some indications that they will not be.

Traffic Notes.

The rate cutting at Pittsburgh noted last week was carried a step further on June 16, the Pittsburgh & Lake Erie selling round tickets to Chicago for the Democratic Convention at $6.50. The ticket brokers took advantage of the situation, and sold one-way tickets for $4.50.

The Philadelphia & Reading has lately brought oranges into Philadelphia which came through from Riverside, Cal., in 10 days. The Reading and the Lake Shore, on 202 cars of structural iron for the World's Fair buildings, made an average of four and one-half days from Pottstown, Pa., to Chicago.

The "Soo" line has continued to make reductions in round trip rates from St. Paul to the East, the following being the figures on Monday, the 20th, tickets good to return until Nov. 1: Montreal, $25; Boston, $25; New York, $26. The single trip rates are also low, viz.: Montreal, $20; Boston, $24.50; New York, $20. On May 16 the rates were: excursion Montreal, $45; single trip, $25; Boston, excursion, $48; single trip, $25; New York excursion, $47.50; single trip, $26. The schools in the Northwest have just closed for the summer vacation, and the teachers have the advantage of these cheap rates.

The tonnage and revenue of traffic carried by the Southwestern Missouri river lines from Jan. 1 to June 1 was distributed as follows:

Line.	Per cent. Tonnage.	Per cent. Revenue.
Atchison	20.4	23.0
Alton	11.9	12.7
Burlington	20.5	19.5
St. Paul	5.1	6.9
Rock Island	8.2	9.0
Chicago, St. Paul & Kansas City	4.0	4.6
Wabash	7.3	7.3
Missouri Pacific	22.6	17.9
Total	100.0	100.0

The discrimination in tolls on the Welland and other canals used by boats running from Chicago to Ogdensburg, which has been complained of by these boats for some time was made the subject of a special communication to the Senate by President Harrison last week. Negotiations between the United States and the Canadian governments looking to a settlement of the grievance have been pending for several months, but the President regards the chances of settlement as so small that he has concluded to turn the whole question over to Congress. The discrimination is claimed to be a violation of the Treaty of Washington, but it seems to be in conformity to the letter of that treaty (which provides that citizens of the two countries shall be treated alike) while working a marked discrimination between them as a practical fact. The rate of toll is 20 cents a ton, with a rebate of 18 cents on freight sent for export to Montreal; but as most American vessels do not go to Montreal, and most Canadian vessels do go there, the discrimination against Ogdensburg and Oswego, *as ports*, in effect, discriminates in favor of Canadian as against American carriers.

The Interstate Commerce Commission.

The Commission, in an opinion by Commissioner Knapp, has decided the case of the Eau Claire Board of Trade against the Chicago, Milwaukee & St. Paul and others in favor of the complainants. The points decided are, briefly, as follows:

Where all the distances brought into comparison are considerable, and the differences between them relatively small, there should be substantial similarity in the respective rates unless other modifying circumstances justify disparity. That rates should be fixed in inverse proportion to the natural advantages of competing towns, with the view of equalizing "commercial conditions," is a proposition unsupported by law, and quite at variance with every consideration of justice.

On complaint of a relatively unreasonable rate on lumber from Eau Claire to various points on the Missouri River, as compared with rates to the same points from La Crosse, Winona and various other lumber shipping points, it is held that the question must mainly be determined by comparing the rate in question with the rates from neighboring towns, similar in size, situation and volume of competing traffic, and approximately the same distance from common markets; that the rate complained of subjects Eau Claire to undue prejudice and disadvantage and is unlawful, and that such rate should not exceed the rate from La Crosse and Winona by more than 2 cents per 100 lbs., when, as at the time complaint was filed, the rate from those points is not over 11 cents per 100 lbs. nor more than 2½ cents per 100 lbs. above the present rate of 16 cents.

Eastbound Freight Shipments.

Eastbound shipments of freight from Chicago by all the roads last week amounted to 56,122 tons, against 53,736 tons during the preceding week, an increase of 2,386 tons, and against 44,100 tons for the corresponding week last year, an increase of 11,982 tons.

GEO. WESTINGHOUSE, JR., President. T. W. WELSH, Supt. JOHN CALDWELL, Treasurer. W. W. CARD, Secretary. H. H. WESTINGHOUSE, General Manager.

THE WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH, PA., U. S. A.,

MANUFACTURERS OF THE

WESTINGHOUSE AUTOMATIC BRAKE

The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 24,000 engines and 325,000 cars. This includes (with plain brakes) 232,000 freight cars, which is about 23 PER CENT. of the Entire Freight Car Equipment of this country, and about 80 per cent. of these are engaged in interstate traffic, affording the opportunity of controlling the speed of trains by their use on railways over which they may pass. Orders have been received for 173,000 of the Improved Quick-Action Brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception.

Year.	No. per year.	Grand total.
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

E. L. ADREON, Manager. JOHN B. GRAY, Agent. C. C. HIGHAM, General Supt.

THE

AMERICAN BRAKE COMPANY.

NEW YORK OFFICE, 160 Broadway, JOHN B. GRAY, Agent.

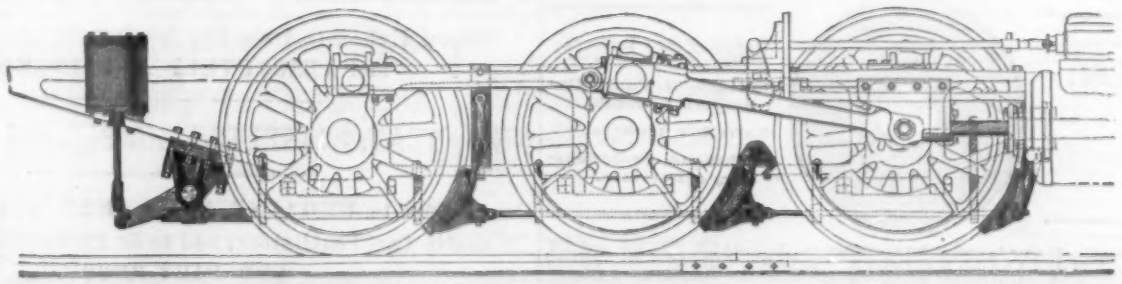
THE WESTINGHOUSE AIR BRAKE CO., Lessee,

MANUFACTURERS OF

CHICAGO OFFICE, GRAND PACIFIC HOTEL.

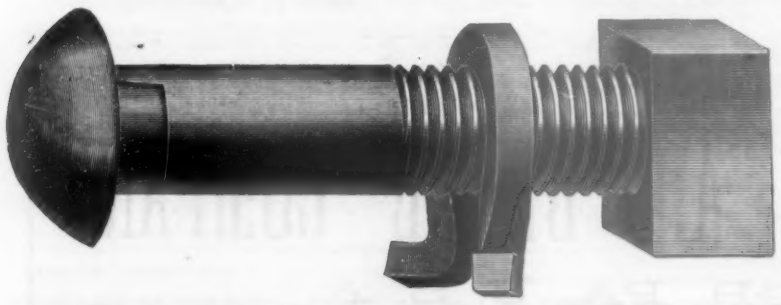
LOCOMOTIVE BRAKES.

General Offices and Shops, Second and Tyler Sts., ST. LOUIS, MO., U. S. A.



Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers furnished to operate with either STEAM AIR or VACUUM.

THE "STANDARD" NUT LOCK



Manufactured under D. O. Ward's Patents by the

STANDARD NUT LOCK CO.,

NOS. 236-248 BANK ST., NEWARK, N. J.

SAMPLES FREE.

This nut lock is presented on its merits as the best and cheapest device for securing track joints.

It is a torsional loop made of good quality of tempered spri g steel, having horizontally inclined foot pieces, which are curved inward, thereby gr atly increasing the spring resistance and acting simultaneously; rests upon the base of angle bar, or underlying rail base in case of fish plate, preventing the loop portion from rotating and hammering down *thread* of *bolt*.

The nut lock for ⅞ bolt made of ¼ in. square steel, standard pattern, yields a tension of 4,300 lbs. on the bolt, which is sufficient to reduce the wear of the bearing surfaces of the angle bars on the rails, imparting, as it does, a uniform bearing the entire length of the bar.

The "Standard" Nut Lock has sufficient elasticity to maintain a tight joint, which cannot be truthfully said of many light-weight single coil washers.

The "Standard" Nut Lock is, in its superficial form, similar to an annular coil twisted out of plain, i. e., the curved shoulders or ends of the loop proper are spread in the usual manner of spring coils, at which bearing points the locking friction is equal to that of the best single coil washer, and added to this it is terminated in *inwardly curved* extensions, which must apparently furnish additional short leverage spring force of a torsional character.

Distinctive Merits of the "Standard" Nut Lock, Condensed:

Fixedness of position—cannot rotate and hammer down threads of bolt.

Cannot get one end into elongated slot of angle-bar.

Unlike any permanently placed, double washer, the Standard *is* interchangeable regardless of distance between bolts.

Cannot be put on wrong side out, as the outward projection of the foot pieces would prevent the nut being turned up.

Has more spring power directly under the nut than any two ordinary coil nut locks.

Being fixed in position it offers double the locking friction of nut locks, which when in their *dead* "set" condition turn back with nut by the vibrative effect of passing train.

The "Standard" Nut Lock embodies the old principle of spring power improved by overcoming the objection to the double washer or nut lock, and covering the weak points of the single coil washer.

THE STANDARD COMBINATION TIE PLATE AND BRACE

POSSESSES THE FOLLOWING MERITS:

1. It prevents absolutely the canting of the rail into the tie, thereby greatly increasing the life of the tie.
2. It prevents the rails from spreading or canting over and wearing one side only.
3. The combination of the brace and plate obviates the necessity of spiking the rail and brace separately, thereby saving two spikes and securing the service of the *inside* spike for *holding* the rail; it also prevents the rail from working up and down, and laterally, thus making it impossible to wear the *neck of the spike*.
4. The plate and brace being made of malleable iron, is practically indestructible.

The tie plate and brace is especially useful for curves and guard rails, and also on bridges, whether the rail is laid on ties or on stringers. A tie plate without a brace will not save the head of the spike. A brace without a tie plate will not save the tie, and in a short time the rail will wear into the tie.

P. O. Box 288, PHILADELPHIA, PA. WILLIAM H. PHILLIPS.

Simple. Easily Applied. Very Effective.

THE NATIONAL LOCK WASHER

THE ONLY POSITIVE NUT LOCK IN COMBINATION WITH ELASTICITY.

Sixty Millions in Use in Railroad Track

For Use on All Kinds and Classes of Work.

Made for all sizes of bolts.

A trial is requested.

Samples free of expense.

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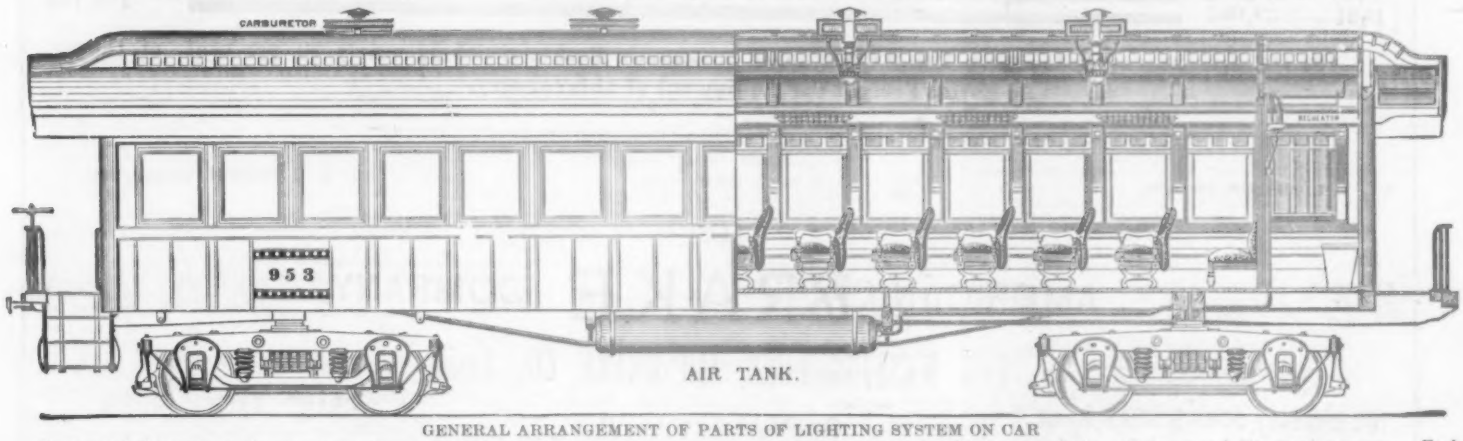
THE FROST DRY CARBURETOR SYSTEM OF CAR LIGHTING.

The Greatest Light of the Age. Extensively Used by the Pennsylvania Railroad and the Pullman Palace Car Company.



GENERAL ARRANGEMENT OF PARTS OF LIGHTING SYSTEM ON CAR

It cannot fail to attract the attention of practical railroad managers on account of its absolute safety, durability, simplicity, efficiency and its great economy. Each lamp gives 100 candle-power illumination. One hundred hours' continuous service from one charging of the carburetor.

THE RAILROAD LIGHTING & MFG. COMPANY. Office, 700 and 701 Girard Building, Philadelphia, Pa., U. S. A.

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PASSENGER CAR VENTILATORS.

Strong Exhausts from the Impinge of the Outside Air, and ABSOLUTELY ANTI-INGRESS.

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Guaranteed to EXHAUST MORE THAN ANY OTHER Automatic Car Ventilators, and to Be PERFECTLY STORM AND DIRT-PROOF.

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RELIABLE AND UNIFORM HEAT. ECONOMICAL AND RAPID CIRCULATION.
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THE CELEBRATED PINTSCH COMPRESSED OIL GAS METHOD
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Beech Creek Railroad,
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CARS FOR EXPORT
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Manufacturers of Passenger, Sleeping, City, Baggage and Freight Cars.
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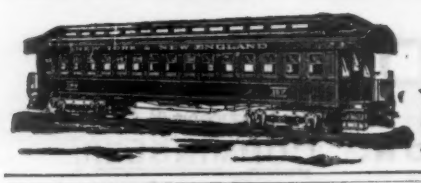
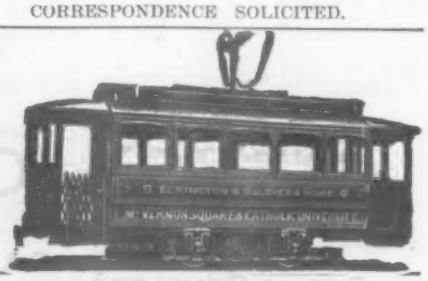

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Solid Steel OR Malleable Iron, WITH *Steel Knuckle.*

Simplest, Strongest Best.

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Furnishes CREOSOTED MATERIAL of all kinds by the cargo and carload. Manufacturers of WOOD CREOSOTE OIL, the only oil used at their works in protecting timber against decay and the ravages of the seaworms. Shipping facilities unsurpassed by rail and water. Write for circular and prices. B. T. BURCHARDI, Chief Engineer and Superintendent.

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Van Dorston Cushioned Car Coupling Equipment Co.

VAN DORSTON CUSHIONED CAR COUPLER.

M. C. B. TYPE.

Lightest, Strongest and Best. Automatic Self-Opening and Self-Adjusting. Insures Safety to Trainmen. Independent Double-Acting Gravity Lock. No Slack Required to Uncouple.

Also the **Van Dorston Single, Double and Triple-Acting Cushioned Draught Gear.** Seventy-five per cent. reduction in shocks on the part of the couplers and car bodies, and consequent great economy in repairs. Increase in yard room of from 12 to 18 cars per 1,000. Correspondence respectfully solicited.

Van Dorston Cushioned Car Coupling Equipment Co., No. 305 Walnut St. Philadelphia, Pa.
EDWARD H. JOHNSTON, President.

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Automatic Freight Car Coupler.

Locomotive and Car Axles, Coupling Links and Pins.

M. C. B. Passenger Coupler. Used in Place of Miller Hook Without Change in Platform.

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Gould Coupler Co.

Buffalo Office and Works,

AUSTIN ST.

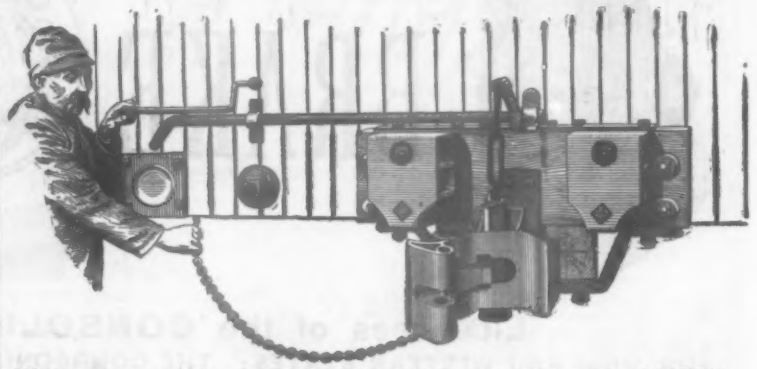
Gould Continuous Platform and Buffer.

Gould Vestibule.

STANDARD COUPLER.

(DOWLING TYPE.)

Drawhead, Malleable Iron; Knuckle, Pressed Steel; Pin, Drop Forged Steel.



With Chain Attachment for Opening the Knuckle WHEN REQUIRED.

THE STANDARD CAR COUPLING CO.,

New York Office, 45 Broadway. Chicago Office, 1018 The Rookery.

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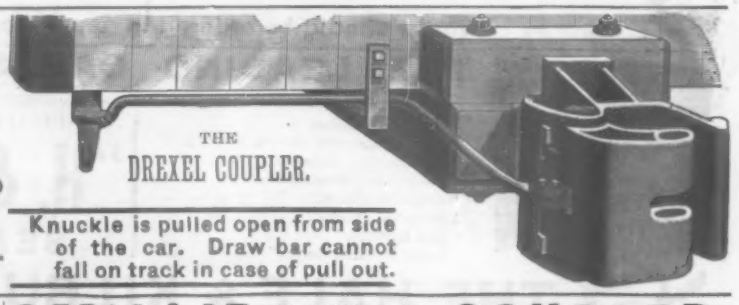
The DREXEL JOURNAL BOX LID

of Pressed Steel with a Central Bearing Spring. Cost of maintenance reduced to minimum with maximum efficiency.

The Rookery, - - - CHICAGO.

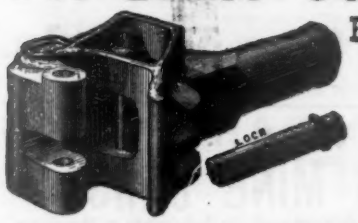
Eastern Office: COLUMBIA BUILDING, NEW YORK.



THE DREXEL COUPLER.

Knuckle is pulled open from side of the car. Draw bar cannot fall on track in case of pull out.

ST. LOUIS STEEL COUPLER,



FREIGHT, PASSENGER AND TENDER COUPLERS.

ST. LOUIS CAR COUPLER CO.,

ST. LOUIS, MO.

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SMILLIE DOUBLE LOCK COUPLER.

TENSILE STRENGTH (Fairbank's Test) 139,640. DROP TEST, 700 lbs. hammer dropped 18 ft. 22 times failed to break the knuckle.

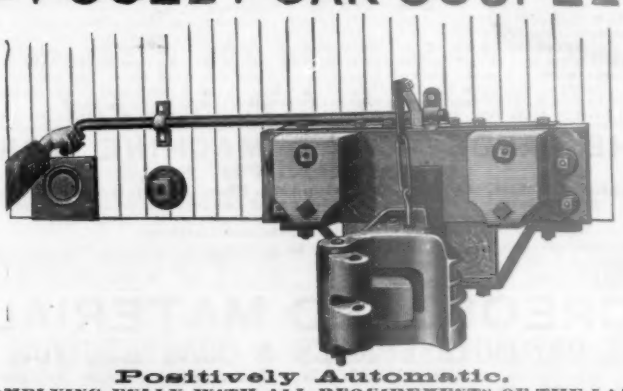
Direct drop of full sized pin makes a double lock formed by draw bar at "C" and Pin "D." Equally strong if pivot pin "A is lost. Should pin be lost, use any link—no chains being required. The strongest Knuckle and Coupler known. Cannot be unlocked by any jolt of the cars. Couples with all M. C. B. types. The locking pin drops behind the step on rear of Knuckle "K," and keeps the knuckle always open when cars are separated. Removing the pivot pins, 33 loaded gondola cars were drawn from Paterson, N. J., to West End (18 miles), the pull being entirely on the DOUBLE LOCK.

The drawbar is Malleable Iron. The Knuckle Pivot and Locking Pins steel.

THE SMILLIE COUPLER & MFG. CO.,

52 Broadway, New York. Works, 91 Clay St. Newark, N. J

THE POOLEY CAR COUPLER.



Positively Automatic.

COMPLYING FULLY WITH ALL REQUIREMENTS OF THE LAW.

SIMPLE. STRONG. EFFECTIVE

PRATT & LETCHWORTH, MANUFACTURERS, BUFFALO, N. Y.

TROJAN CAR COUPLER.

M. C. B. TYPE.

THE STRONGEST AND THE ONLY SAFETY COUPLER.

The knuckle may be thrown open for coupling by the hand-rod at the side of the car, rendering it unnecessary for trainmen to go between the cars to open the knuckle. The action is positive, and not dependent on springs or gravity.

The lock has a bearing of four square inches on the knuckle.

N. O. Olsen, Engineer of Fairbanks & Co.' testing department, says: "IT IS THE STRONGEST COUPLER NOW IN THE MARKET

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New York Office, 11 Pine street. TROY, N. Y

McGILL THE VERTICAL PLANE MUST GO

World's Fair

SETTLES THE QUESTION.

See the other "ad."

Freight Passenger CAR McGILL IRON WORKS CO. PEORIA, ILL.

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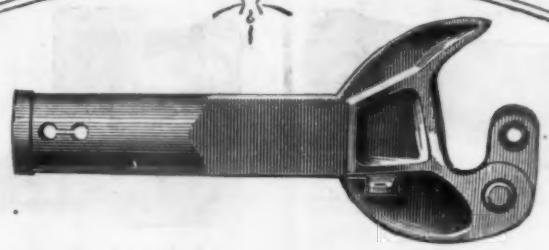
PASSENGER, FREIGHT, TENDER.

HINSON COUPLERS

The Hinson Car Coupler Co., 518 Rookery, Chicago. 31 & 33 B'way N. Y.

THE JANNEY FREIGHT CAR COUPLER



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Agents & Manufacturers For

THE JANNEY-HIEN COMPANY

THE BUCKEYE COUPLER.

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Master Car Builders' Standard in every particular. Combines the greatest obtainable strength and simplicity. Only Three Parts. Positive acting gravity lock and positive mechanical opening of knuckle. Absolute Central draft. Same movement that raises the lock throws open the knuckle.

Sold with a GUARANTEE to Stand the Proposed M. C. B. Drop and Pulling Tests.

Adopted as Standard by Several Leading Railroads After Severe Tests and Long Trials.

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The Lightest, Simplest and Least Expensive Coupler in the Market.

WEIGHT 180 POUNDS.

MEETS ALL THE REQUIREMENTS OF THE M. C. B. LINES AND TESTS.

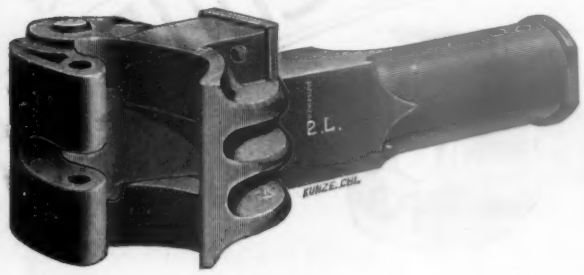
LOCKING DEVICE SIMPLE, DURABLE AND EFFECTIVE

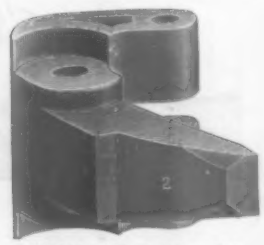
It Has but Four Parts and Cannot Be Opened by Accident.

KNUCKLE OPENS AUTOMATICALLY

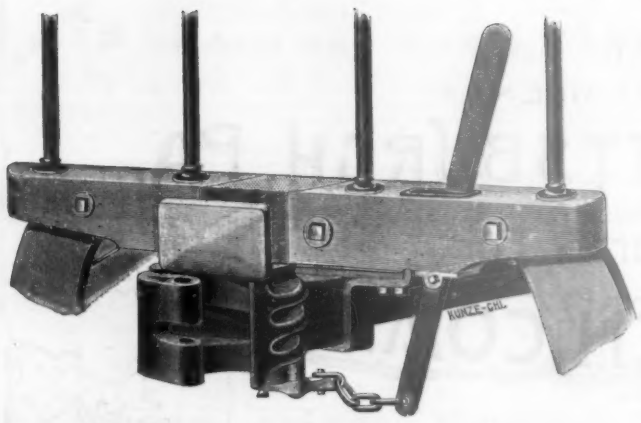
FREIGHT COUPLER.

2 L, BOTTOM LOCK.





KNUCKLE (No. 2)



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PASSENGER, FREIGHT, TENDER.

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Write for Blue Prints, Prices and Terms.

The Distinctive Features of the Hinson Are Strength, Durability, Ease and Certainty of Operation.

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New Model 1891, with Pivot Pin, and Top Lock operated by Overhead Unlocking Device.

DRAW-BAR (1 L).

LOCK Nos. (3--4.)

The Hinson Draw-Bars are made of the best malleable iron, and the Knuckles of the toughest Open Hearth Steel.

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MANUFACTURERS OF

CHILLED WHEELS OF ALL PATTERNS AND SIZES FOR EVERY SERVICE, AND WITH OR WITHOUT AXLES.

CAPACITY, 400 WHEELS PER DAY.

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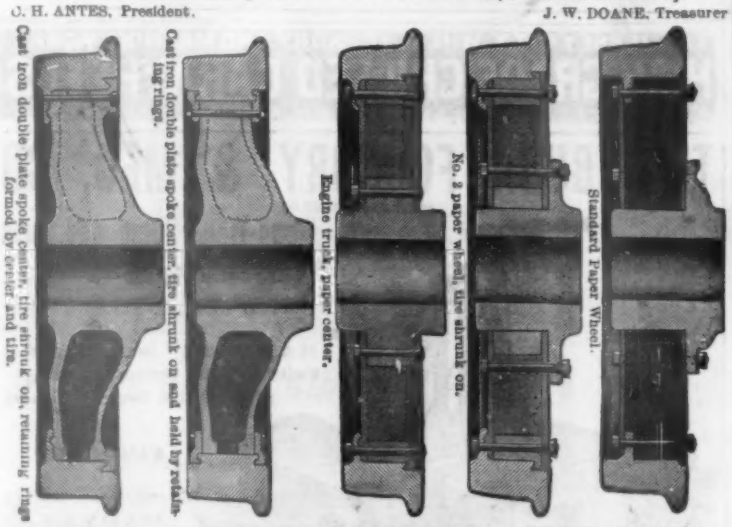
Works, Hudson, N. Y. **ALLEN PAPER CAR WHEEL CO.** Works, Pullman, Ill

General Office, Chicago, Ill. New York Office, 31 and 33 Broadway.

O. H. ANTES, President. J. W. DOANE, Treasurer



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DICKSON CAR WHEEL CO.,

Manufacturers of all Sizes of ENGINE, TENDER and

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In either the COMMON or

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CAST-STEEL WORKS

Of FRIED. KRUPP, Essen, Germany.

REPRESENTED BY

THOMAS PROSSER & SON

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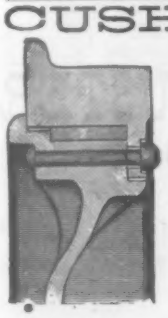
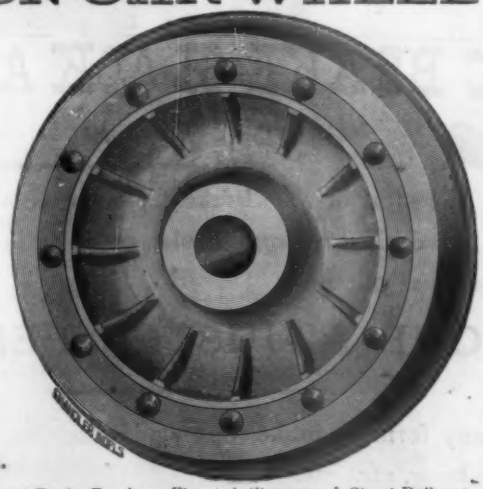


RECORD 40,000 MILES. 1-16 INCH WEAR.



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Durability.
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Elasticity.
Safety.
Noiseless.

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Double Plate, Single Plate AN Hollow Spoke WHEELS FOR Broad and Narrow-Gauge Cars Engines and Tenders.

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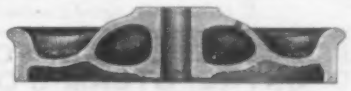

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CRUCIBLE STEEL-TIRED WHEELS,

For Parlor and Sleeping Cars, Passenger Coaches, Locomotive and Tender Trucks.

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ALL WHEELS GUARANTEED TO STAND ONE YEAR

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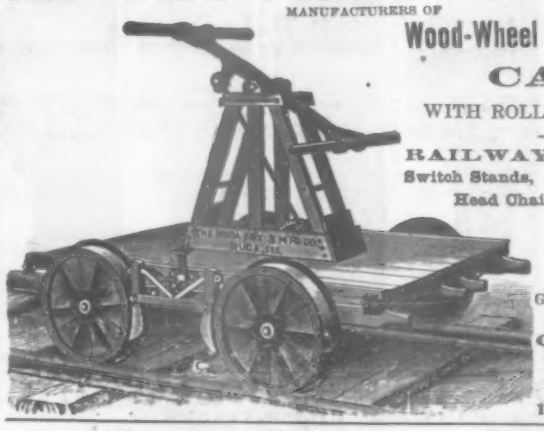

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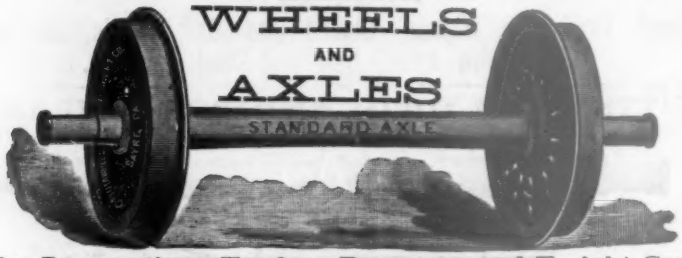

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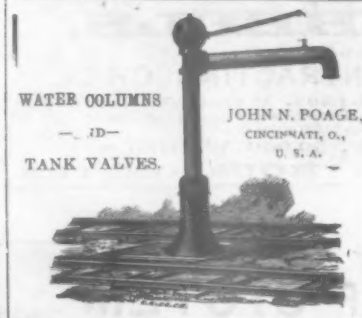

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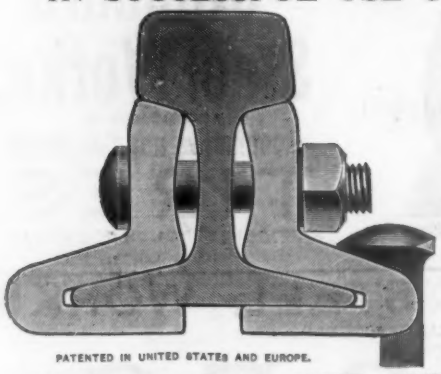
ELECTRIC and CABLE STREET RAILWAYS.
IN SUCCESSFUL USE ON 48 ROADS.



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By its use the rail is made as strong at the joint as it is at the centre of the rail as it lies in track.

It is simple and easily applied, and has always given satisfactory results.

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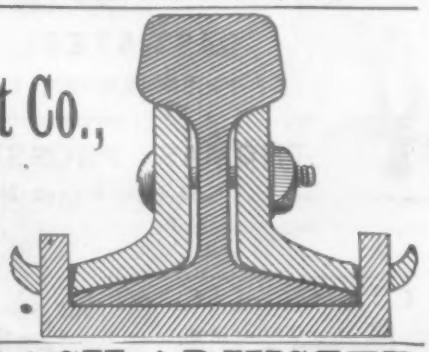

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Simple. Compact. Effective.

Piston of Air Brake Cylinder is automatically kept at any desired uniform stroke, resulting in full, effective piston pressure at all times.

ONE ADJUSTER PER CAR.

Uniformly applicable to any form of brake rigging, Passenger or Freight, whether brakebeams are outside or inside hung, etc., etc.

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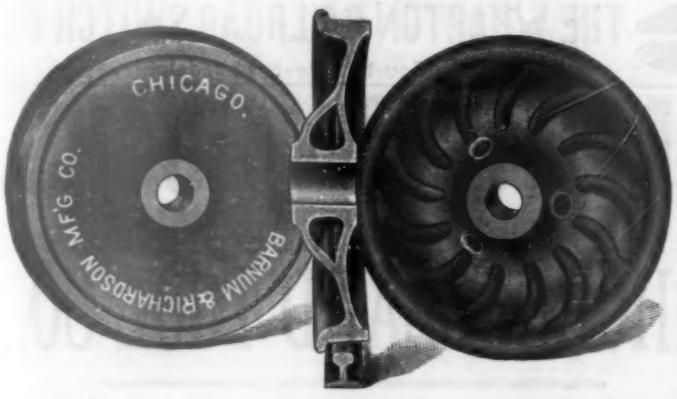

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STREET CAR WHEELS,

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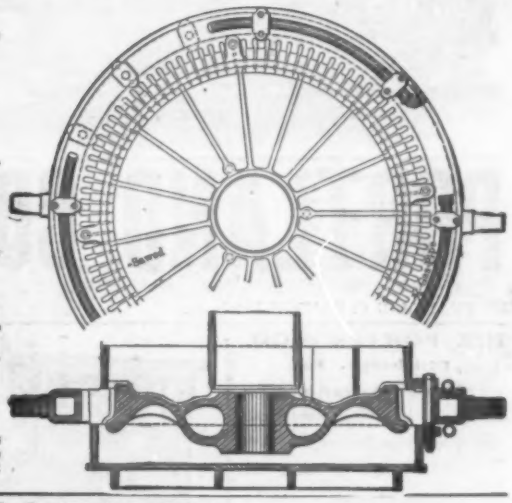

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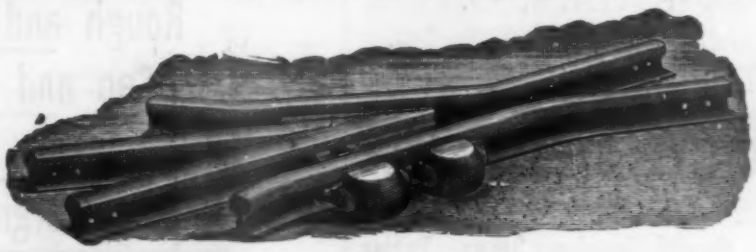
Automatic Stand, Showing Position of Parts while being Thrown by Hand.



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Automatic Stand, Showing Position of Parts while being Thrown Automatically by Train.

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CHILLED IRON CAR WHEELS

FROM SPECIAL QUALITY CHARCOAL IRON

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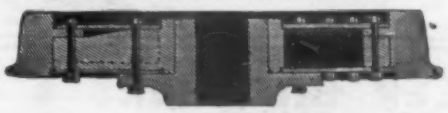
BOLTED—WITH WROUGHT-IRON PLATES, CAST-IRON CENTRE AND INTERCHANGEABLE HUB.



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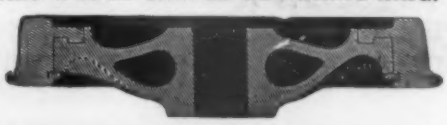

Both of these Wheels can be Re-tired in any Ordinary Machine Shop

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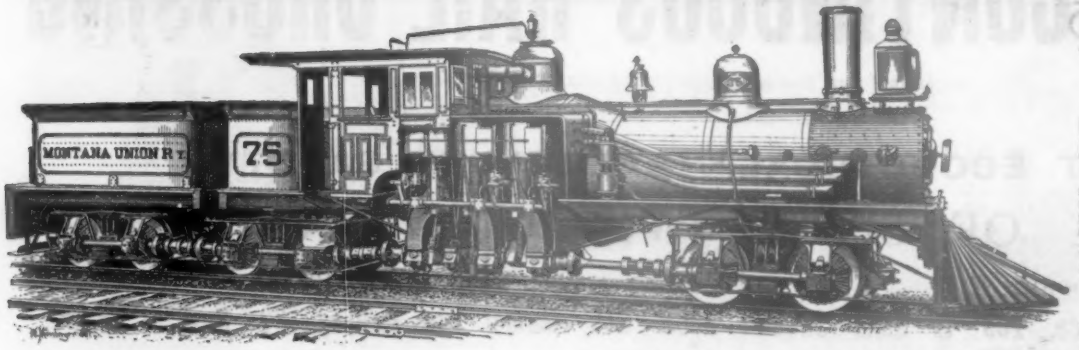

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Built to weigh from 7 tons up to 90 tons on drivers, and are especially adapted for service on roads where there are heavy grades and sharp curves. These locomotives are working successfully on grades of 9¼ per cent., and on curves of 100 feet radius. We also build
Standard Types of Light Locomotives,
Mining Cars of all Kinds,
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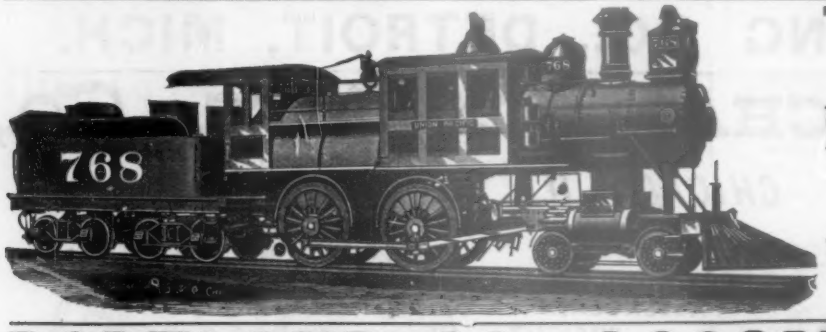
Write for Particulars.



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MECHANICAL AND ELECTRIC
INTERLOCKING AND BLOCK SIGNAL SYSTEMS.
Every Variety of Track Supplies. Heavy Tools.
MACHINISTS AND MANUFACTURERS.
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LIGHT LOCOMOTIVES
And Noiseless Street Motors,
And for all gauges of track. All work steel fitted and interchangeable. Duplicate parts kept in stock.
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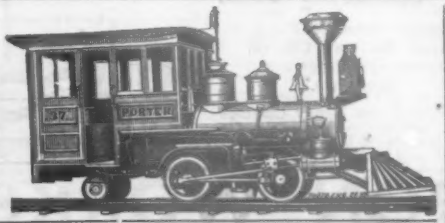

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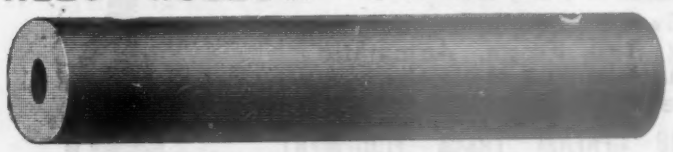

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Rolled Hollow Staybolts Are Stronger and Safer than Drilled Ones.
Mandrel rolled from the finest charcoal iron. All sizes, from ⅜ to 1⅛ inch, with any sized hole required from ⅛ to ⅞ inch. Let us send you a sample and quote prices.
A set for one firebox will convince you of their merits, safety and economy.

IMPROVED LOCOMOTIVE STEAM GAUGE

SPRINGS MADE FROM
Special Seamless Drawn Tubing.
The ONLY Locomotive Steam Gauge made where the Movement, Springs and all Moving Parts are Detached from the Back of the Case.
Case Fitted with our Patent Elastic Packing to Prevent Dust and Moisture from Entering Gauge.
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Turn Buckles.
Drop Forgings to Order.
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NEW PATENT APRIL, 1891.
6,000 Locomotives Equipped. In use on 175 Railroads.
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Saves $24 per Year per Engine, as Compared with Fibrous Packing.
IN USE ON 240 RAILROADS OF THE WORLD.

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KRUPP'S STEEL TIRES

On Locomotive Driving Wheels.
GIVE THE BEST RESULTS
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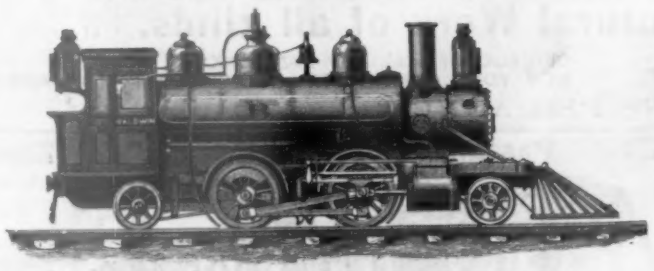

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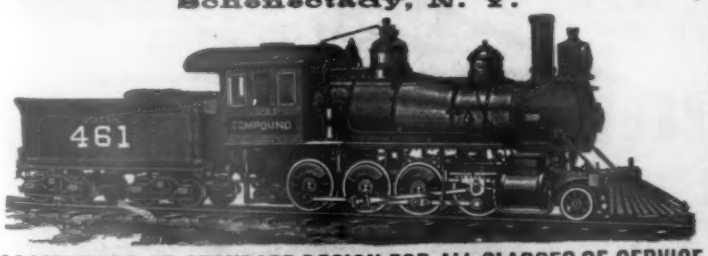

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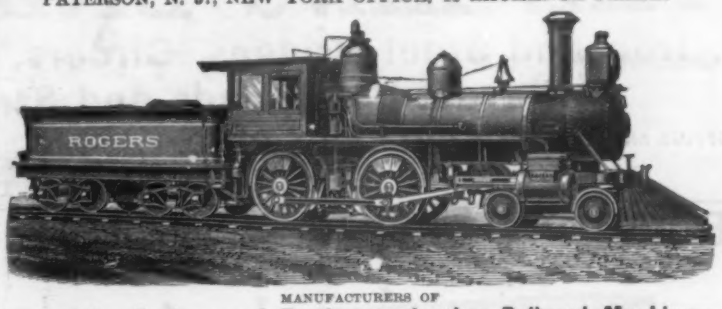

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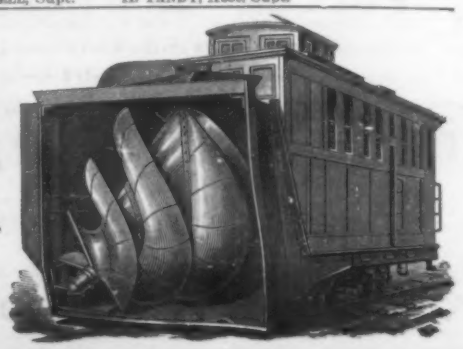

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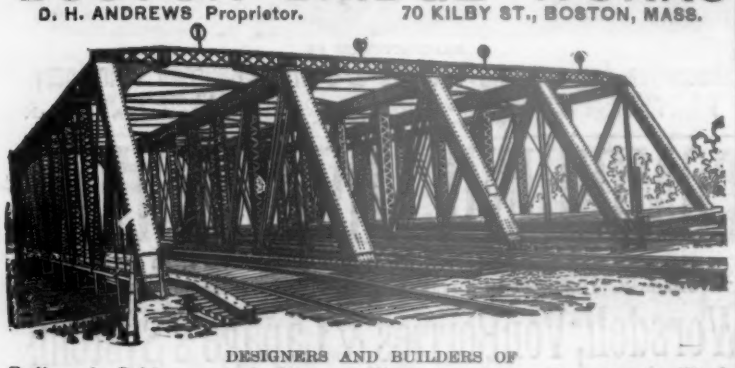

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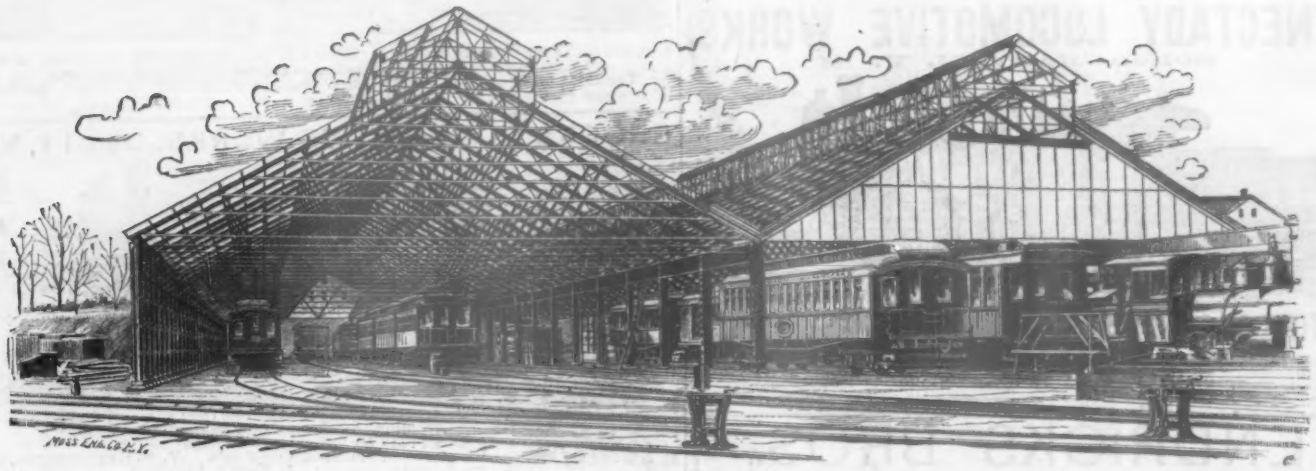

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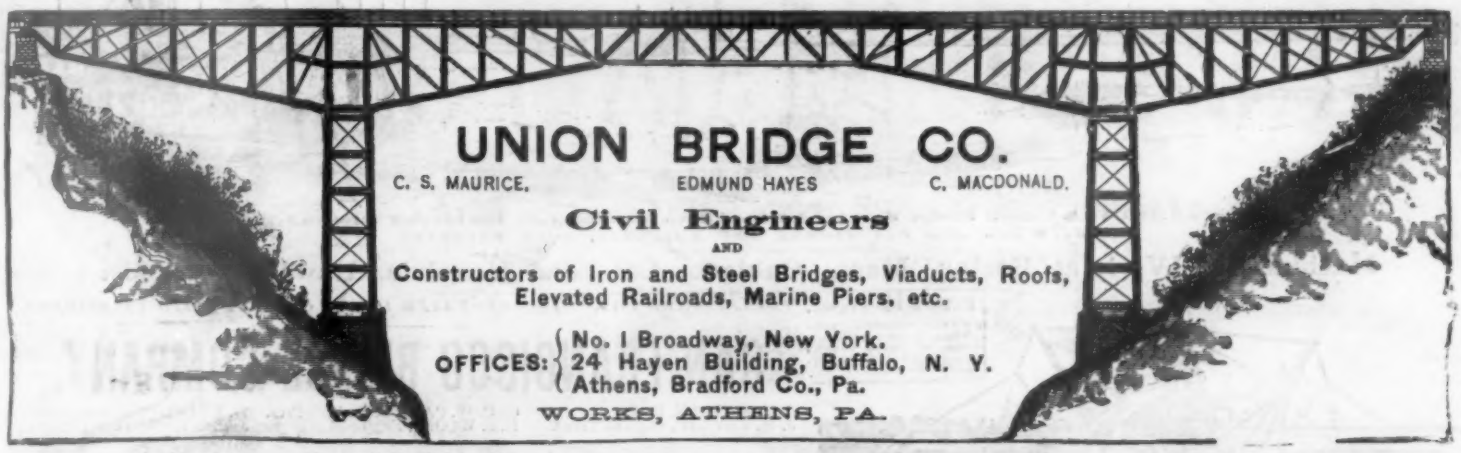

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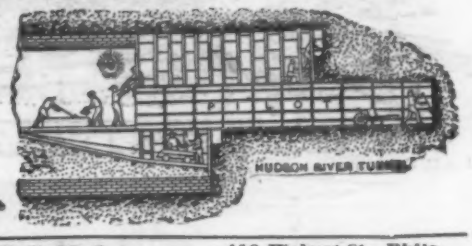

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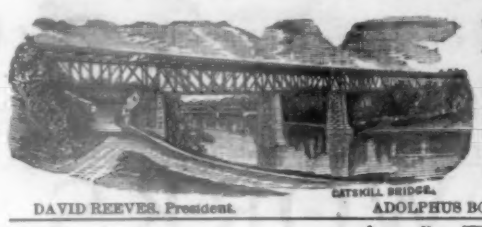

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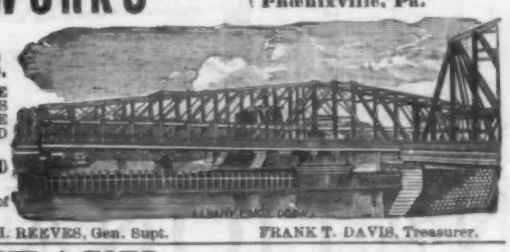

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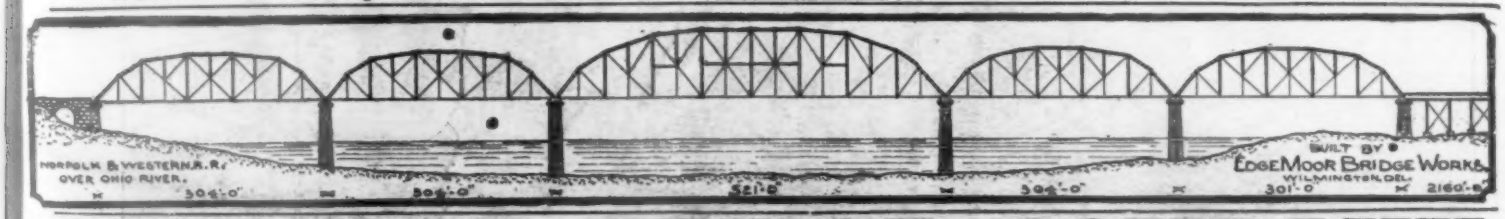

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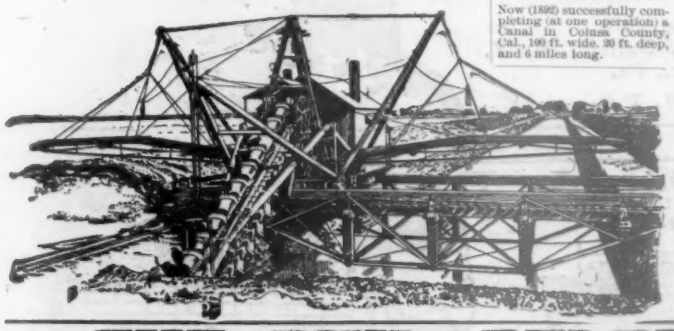

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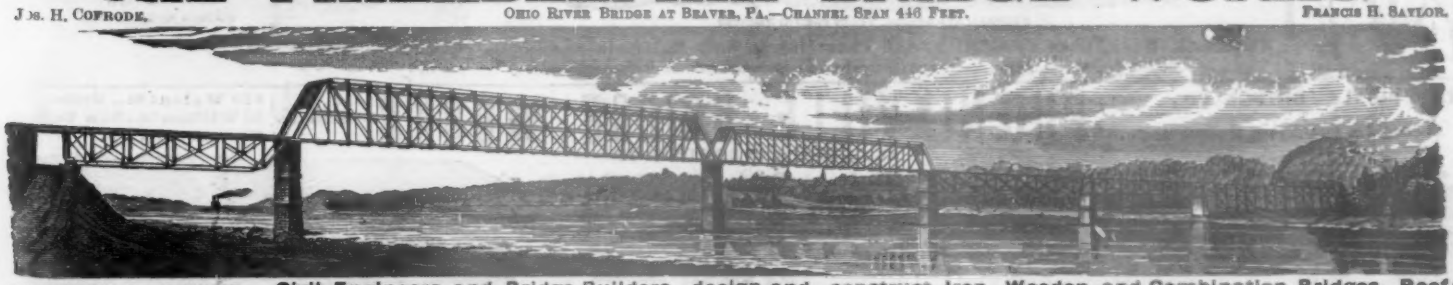

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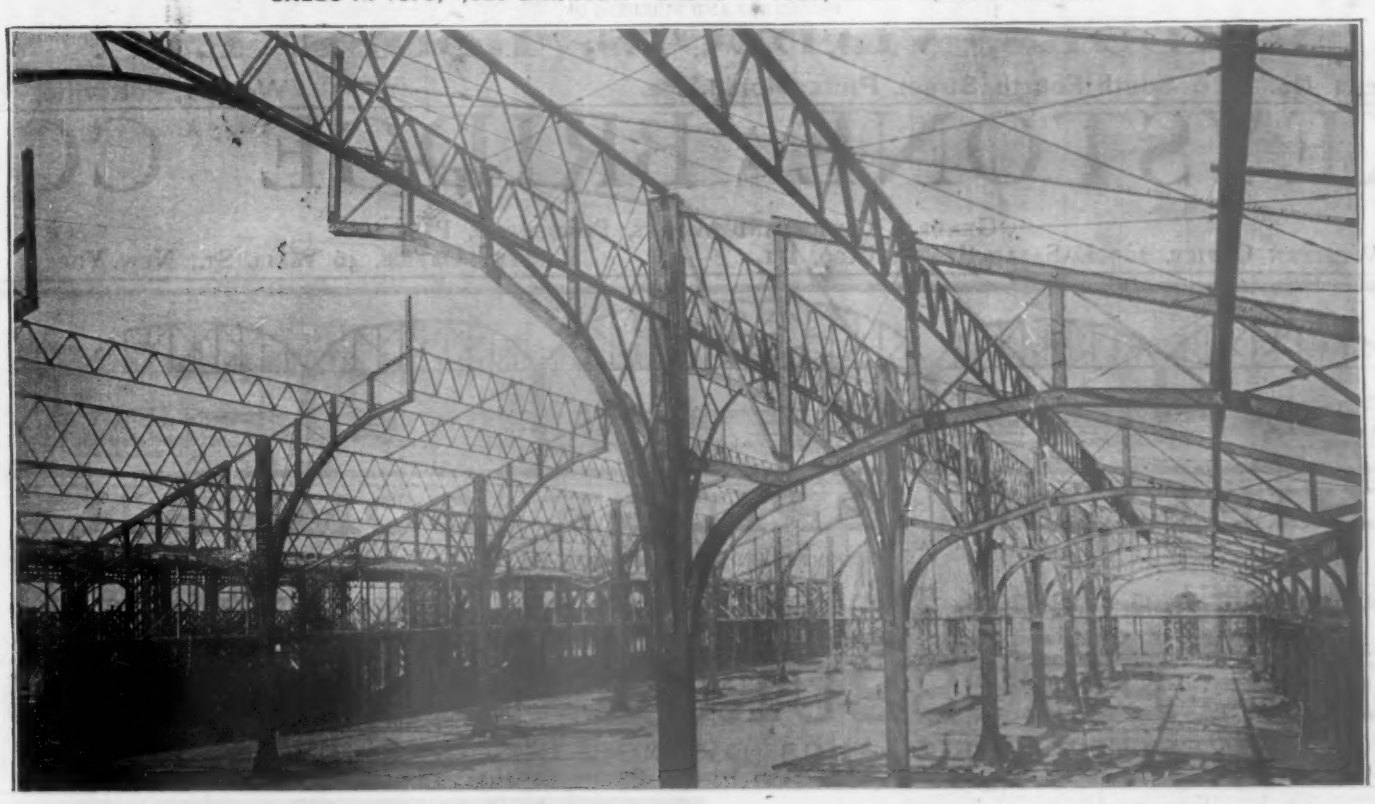

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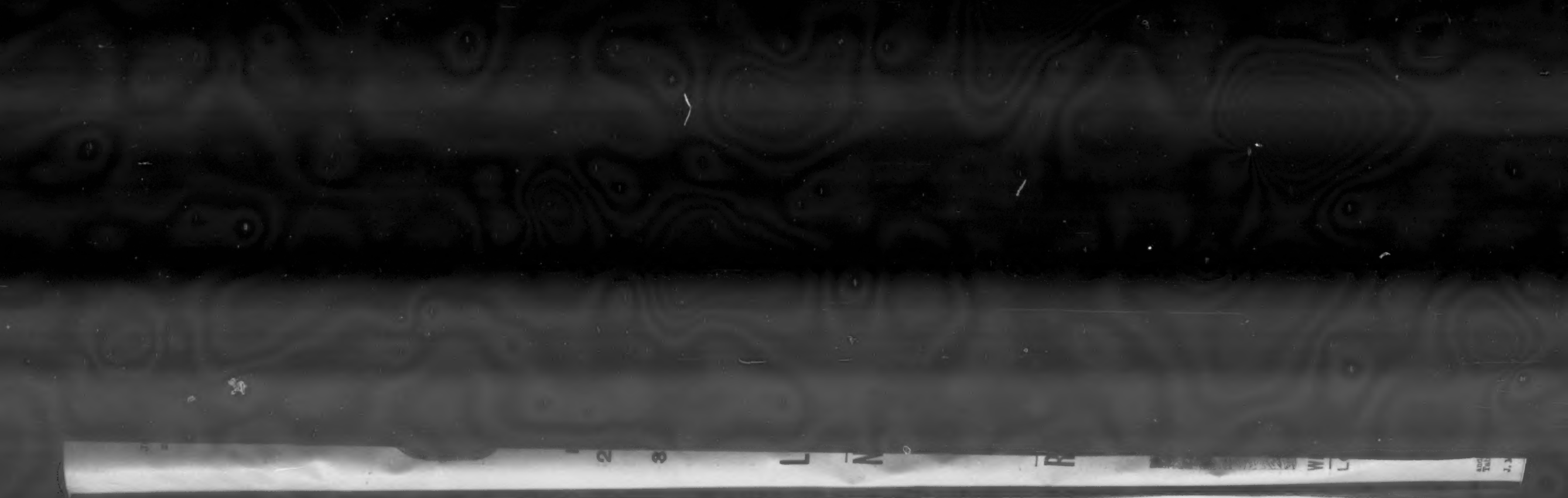

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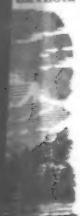

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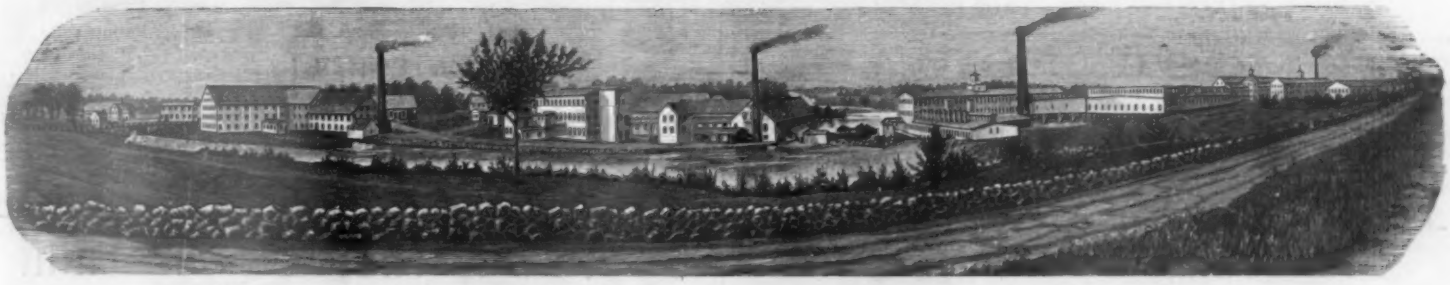

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